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ABSTRACT

The 36 papers contained in this collection from the College and University Computer Users Conference (CUMREC '93) are grouped under six topic areas. The main subject areas and examples of the topics covered are: (1) computer-based student support systems, including telecounseling and recruiting, a student advising system, the assignment of housing, academic planning assistance, food service, and a graduate student degree and progress tracking system; (2) student information systems, including the use of interactive voice response technology, electronic transcripts, an online student credit system, a system for managing personal identification numbers, and the exchange of electronic transcripts; (3) finance and administration, including implementation of a paperless workplace, electronic forms processing, and financial management information solutions; (4) information resources management, including education and training, steps toward distributed data access, implementing data administration and strategic data planning, and campus wide information systems; (5) emerging technologies, including open systems, the networking revolution, evolution of smart card technology, image processing, interactive multimedia, and computer downsizing; and (6) strategic planning and management, including improved data access, business reengineering, and a survey on information technology issues in the 1990s. (KRN)

38th Annual
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Hosted by Baylor University
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San Antonio, Texas

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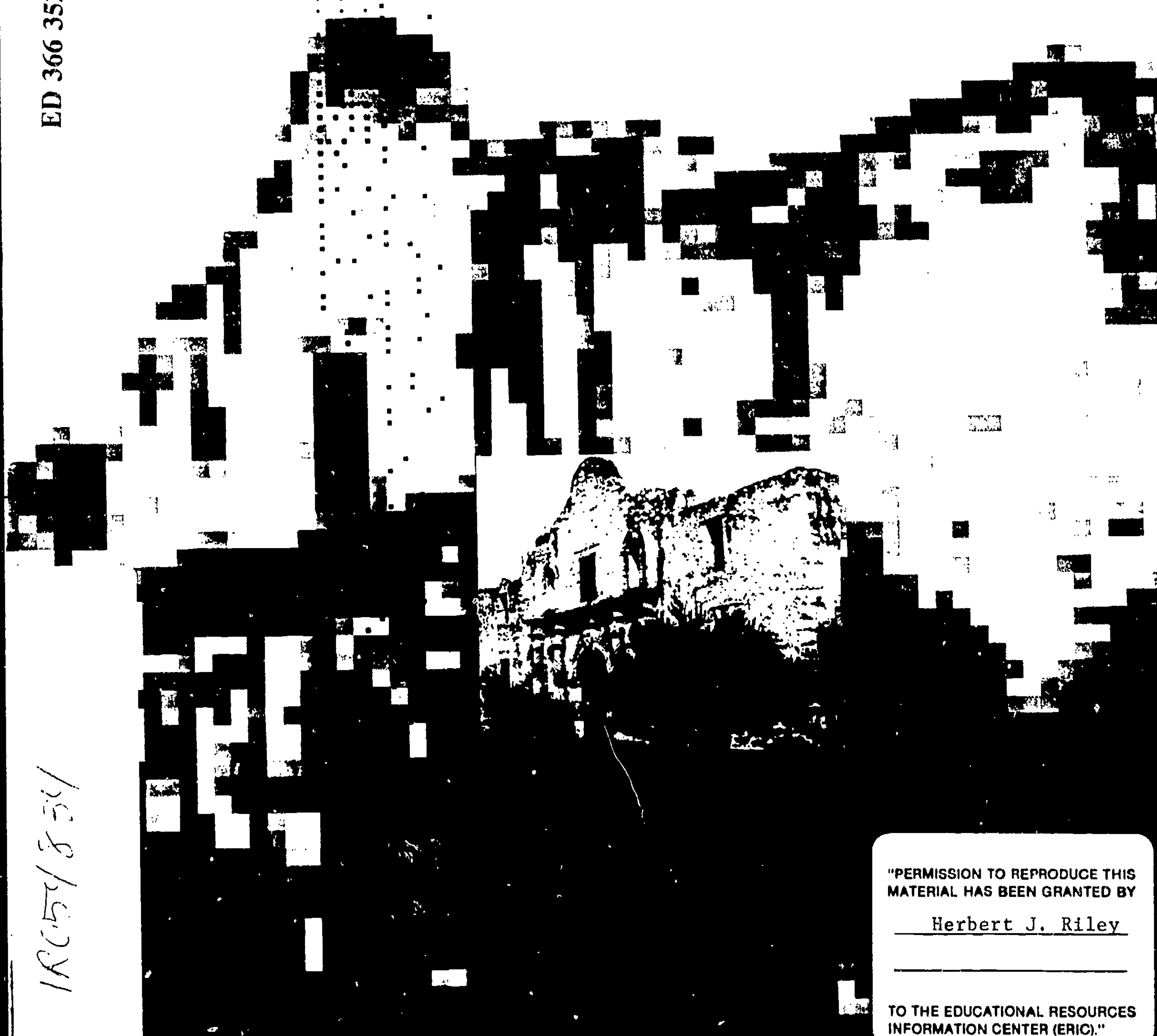
INFORMATION TECHNOLOGY: The Revolution Continues



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INFORMATION TECHNOLOGY: The Revolution Continues

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INFORMATION TECHNOLOGY: The Revolution Continues

STUDENT SUPPORT SYSTEMS

M2-1

Installation of a Telecounseling and Recruiting System at Arizona State University

Jana Brown
John O'Connell
Arizona State University

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INSTALLATION OF A TELECOUNSELING AND RECRUITING SYSTEM AT ARIZONA STATE UNIVERSITY

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THE UNIVERSITY

Arizona State University is part of a tri-university system governed by the Arizona Board of Regents. ASU is a multicampus university with ASU Main located in the city of Tempe, ASU West in northwest Phoenix, a major educational center in downtown Phoenix, and other instructional, research, and public service sites throughout Maricopa County. ASU's enrollment for the Fall 1992 semester was 43,635. ASU offers almost 300 degree programs through nine colleges and one professional school.

THE ENROLLMENT

Like many schools, ASU has been faced with a declining applicant pool of graduating high school seniors and has been considering developing a system that would help to identify, contact, track and enroll prospective students. As early as Fall 1985, a Joint Application Design (JAD) session was held to identify requirements and develop a preliminary design for a marketing/recruiting system for the Undergraduate Admissions office. Periodically, the JAD document would be taken down from the shelf, dusted off and reviewed - but with programming resources being devoted to maintaining existing mainframe systems, the marketing/recruiting project never materialized.

The impetus for taking action came with a decline in new out-of-state freshman enrollment for the Fall 1990 and 1991 semesters. State funding for ASU is based on an amount calculated on full-time equivalent enrollment figures. Since out-of-state students pay a heftier portion of the cost of their education than Arizona residents, a drop in the number of out-of-state students can significantly impact funding for the university. To address this decline in enrollment and to maintain a diverse student population, the administration decided to aggressively pursue the Undergraduate Admissions office's

request for a marketing/recruiting system. Since results were desired for the Fall 1992 semester, decisions needed to be made quickly.

THE CHALLENGE

On Friday, December 13, 1991, the ASU Provost approved the acquisition of a telecounseling/recruiting software system. In order to have a positive impact on Fall 1992 enrollment, an installation target date of January 24, 1992 was established.

The Undergraduate Admissions office was selected as the installation site and the Director of Undergraduate Admissions was identified as the overall project leader. Specific responsibilities of the Undergraduate Admissions office included entering into a contract with an outside vendor for a telecounseling/recruiting system, identifying, implementing and coordinating marketing and recruitment strategies, and overall accountability of the success of the project.

The Student Information Systems (SIS) office, a distributed computing support group within the division of Student Affairs, was given the responsibility of purchasing, testing, and installing all of the required hardware and software and coordinating the voice and data communications requirements - within the twenty-six working days before the target installation date.

THE VENDOR AND THE SYSTEM

Noel/Levitz Centers for Institutional Effectiveness and Innovation Inc., an Iowa based educational consulting firm, was selected as the vendor. Noel/Levitz markets a telecounseling system called DIALOGUE™. DIALOGUE™ is a telephone communications system that enables personalized communications and promotes relationship building with prospective students. Designed to run on a local area network (LAN) using the Novell 3.11 operating system, the system will initiate, maintain, track and report on prospecting activities throughout the full recruiting cycle. The system was developed using Clarion 2.1 as the RDBMS. The installation is customized by Noel/Levitz to address the unique needs of each university.

THE LAN

Selection of the Undergraduate Admissions office as the site for the installation of the system meant acquiring and installing a new LAN. Existing workspace was converted to accommodate the new LAN. At ASU, the LAN is a subnet

connected to the university's ethernet backbone. Workstations are connected to the backbone through ethernet twisted pair connections. This allows access to both the LAN and the university's VM and MVS mainframe computers.

A dial-in facility, using CloseUp Remote 3.0 communications software, is used by Noel/Levitz personnel in Iowa to identify and resolve problems with the system. The dial-in facility is also available to SIS support staff to identify and resolve problems with the LAN.

The fileserver is an Everex 486/33 20.8 MIPS server with 16MB RAM and two duplexed 676MB SCSI drives. The workstations are HAL-2001 386/25 CPUs with 4MB RAM and 40MB hard disks. Each workstation has a VGA color monitor and one 1.44MB 3.5 floppy drive. One workstation was designated as the telecounseling supervisor's workstation. The supervisor's workstation has an 80MB hard disk, 8MB RAM, a 2400 baud internal modem, and a 2GB tape backup unit attached.

A total of twenty workstations were purchased, replacing twenty 3270 terminals in the Undergraduate Admissions office. Eight existing workstations were upgraded to permit network access. Twenty-six of the workstations are located in the Undergraduate Admissions office. Two of the new workstations were located in the Student Financial Assistance office and the Residential Life office, respectively, and configured to permit access to the new system.

As part of disaster recovery planning for the Admissions' fileserver, upgrades were acquired for the existing LAN in the SIS office. The SIS server functions as a backup to the Admissions' server. One benefit of having ethernet twisted pair connections is the SIS server does not have to be physically relocated to the Undergraduate Admissions office in the event of a system failure. A batch file on each of the workstations will re-direct access to the SIS server in the event of a system failure in Admissions.

For a summary of the hardware and software installed, reference Attachments A and B.

THE DATA

The data the telecounseling/recruiting system uses comes from several sources. One source is external testing agencies such as ACT and SAT. When a student takes the ACT and/or SAT test, they are given the opportunity to have their scores and other demographic data sent to post-

secondary schools of their choice. ASU receives the prospective student information on tapes that are subsequently read into MVS, downloaded via the TCP/IP FTP facility to the server, and a conversion program loads the data into the system.

Another source of data for the system comes from ASU's FOCUS databases. The FOCUS databases contain extracted student information from the student information system production database. There are three FOCUS databases: Student Records, Financial Aid and Residential Life, which are primarily used for end user reporting. New student data from these three databases are also downloaded via the TCP/IP FTP facility to the telecounseling/recruiting system. Future information on financial aid status will be transmitted electronically from the Department of Education to a LAN server in the Financial Assistance office and subsequently downloaded from the financial aid server to the Admissions' server.

Information on prospective students is also entered manually into DIALOGUE™ as a result of student inquiries to the Undergraduate Admissions office through mail and telephone requests and through programs such as school visits and college nights.

THE SCHEDULE OF EVENTS

As mentioned previously, once the decision to purchase the system had been made, the SIS office had twenty-six working days to install the LAN and communications equipment. What follows is a schedule of significant events, including those twenty-six days, noting certain surprises encountered along the way.

November 12, 1991	Noel/Levitz arrives on campus, conducts interviews with several departments and demos the DIALOGUE™ system.
November 20, 1991	ASU receives Noel/Levitz written proposal for "Activating Enrollment Potential".
November 28, 1991	Happy Thanksgiving!
December 2, 1991	SIS submits a budget outlining the costs of a twenty node local area network.
December 13, 1991	The Senior Vice President and Provost approves acquisition of DIALOGUE™.

December 20, 1991	Orders for all hardware and software purchases processed on CUFS, the university's financial system.
December 23, 1991	Orders for twenty-eight ethernet connections, ten new phone lines, eighteen digital phone sets, twenty-two head sets processed on CUFS.
December 25, 1991	Merry Christmas!
December 31, 1991	Request to the Physical Plant Department for the installation of two variable air volume control units. (This was an unanticipated expenditure resulting from the decision to locate the server in a closet which did not have sufficient cooling capacity).
January 1, 1992	Happy New Year!
January 9, 1992	Request to the Electric Shop to install an electric outlet in the server closet. (This was another unanticipated expenditure resulting from the decision to locate the server in a closet.)
January 13, 1992	Spring semester begins!
January 16, 1992	All hardware and software delivered to the SIS office. Variable air volume controls, electric outlet, Ethernet connections, and phone installations completed.
January 17, 1992	All hardware (20 workstations) checked, ethernet boards, workstations, and LAN server installed in the Undergraduate Admissions office.
January 18, 1992	All software (operating systems, communications, batch files) installed on workstations in Undergraduate Admissions office.
January 19, 1992	Access to VM and MVS systems from 20 workstations tested after 6:00 P.M. (Access testing to the VM and MVS systems had to be done after 6:00 P.M on Sunday because hardware maintenance was scheduled for these systems from 9:00 P.M. Friday the 17th to 6:00 P.M. Sunday

	the 19th. This was an unanticipated scheduling conflict.)
January 20, 1992	Hardware and software installation complete.
	Happy Martin Luther King Day!
January 24, 1992	Target date for system installation.
January 28, 1992	Noel/Levitz installs DIALOGUE™ software on server.
January 29, 1992	First phone call made using DIALOGUE™.

POST-IMPLEMENTATION

Once the first phone call to a prospective student was made on January 29, 1992, the system became an integral part of the daily activities of the Undergraduate Admissions office staff. The impact to the department was enormous.

One staff line was reassigned to Undergraduate :missions from another Student Affairs department to cover the need for a telecounseling supervisor. But, no other new full-time staff were hired to manage or support the system. Existing staff took on additional responsibilities and/or acquired totally new job functions.

At an assessment and planning session held six months after the implementation, the impact on the Undergraduate Admissions office activities were identified and categorized into seven major functional areas. As the activities were formally identified, the impact of the system on the department became obvious, along with the realization that many of the activities overlapped among the functional areas. Each area involved every one of the staff to some extent.

The functional areas identified were:

Management
Recruiting
Data Entry
Technical Support
Telecounseling
Mail Room
Training

__Management__. Management found that they were spending a hefty portion of their time in meetings specifically related

to the system. These meetings included weekly internal meetings with admissions staff, meetings with the vendor to develop recruiting plans, meetings with the vendor to define refinements to the system to customize it to ASU's needs, meetings to promote and gain support of the project from other departments within the university, and meetings with the upper administration to report on progress being made.

Management also reorganized the staff by formally assigning system responsibilities to existing staff and re-assigning several responsibilities to other staff. New reporting relationships were established, but for the most part, the old reporting relationships continued to be in effect, which led to some confusion - depending upon the assignment, staff might report to someone other than their official supervisor. Sometimes it was unclear what should be reported to whom.

Because the telecounseling/recruiting system was ushering in a new era of student recruiting, publications needed to be re-thought and re-written. Scripts needed by the telecounselors had to be developed. Literature about the academic programs at ASU needed to be accumulated and prepared for distribution as Undergraduate Admissions assumed responsibility for a mail room which would send out any information requested by a prospective student. "Individualized" correspondence to follow up on phone calls had to be developed. Management was heavily involved in each of these activities.

Recruiting. Recruiting activities of the Undergraduate Admissions office increased drastically. Prior to the advent of the telecounseling/recruiting system, the admissions recruitment function was carried out by staff who made individual visits to in-state high schools and community colleges, hosted special on campus events, and were available to meet with students and parents who came to visit campus. Out-of-state recruitment was limited to occasional college fairs, trips which combined staff attendance at professional conferences with short recruiting stops at local institutions, and representation by out-of-state ASU alumni and current students at hometown events.

Once the system was operational, the Undergraduate Admissions office found themselves with twenty additional part-time student employees who had the capability of generating hundreds of prospective student contacts per night. In most cases each of these contacts produced a follow up activity - either a system generated letter with accompanying requested information, a referral to another department or admissions counselor, and/or a follow up phone call.

In addition to the general increase in recruitment activity, the recruitment function also collaborated on the design and content of the revised publications, the departmental literature, and participated in publicizing the recruitment efforts to other university departments.

Data Entry. The data entry function existed in the Undergraduate Admissions office, but (with regard to recruitment) had been done on a stand alone PC using an admissions developed dBase III+ application. Prior to the implementation of the new system, basically only the name and address of prospective students was being entered in order to produce mailing labels. The new system dramatically increased the amount of data being collected and input for each student and also required the data entry personnel to make some subjective decisions.

Also, before the new system, inquiries for information about the university received by phone or incoming mail only required the admissions staff to write down the name and address. Now they not only had to learn how to use the new system, but they also had to start requesting more information from the prospective student. Data entry manuals had to be developed and staff slowly converted to the new method.

Technical Support. The functional area noticeably experiencing the biggest change as a result of the new system was technical support. Prior to the advent of DIALOGUE™, technical support in Undergraduate Admissions was minimal and non-formalized. When the department had a problem with their hardware or software, they contacted the appropriate on campus agency for assistance. In order to enhance their local support, they had recently reclassified an existing position to provide departmental computing support, with the specific goal of developing a new student orientation application. This new position had been filled only a short time before the decision was made to acquire DIALOGUE™.

The new computing support staff member suddenly found his time being consumed by a project that had not even been on the agenda at the time of his hire. Not only was he supporting the daily computing activities that previously existed, he was also thrust into learning the intricacies of a new system and assuming the responsibilities of LAN administrator.

Getting new users set up on the network, providing requested reports from the new system, interfacing with Noel/Levitz personnel to resolve system problems and coordinate changes, developing procedures and automating

processes to smooth the daily routine soon became a full-time job. To relieve some of the responsibility from this position, the SIS office was asked to devote a staff member 50% time to assist Undergraduate Admissions with technical support. Undergraduate Admissions is currently in the process of hiring a full-time programmer to permanently assist in the technical support area.

Telecounseling. This functional area was non-existent prior to DIALOGUE™. Telecounseling affected every other functional area. The telecounseling function is primarily supported by part-time student employees who work from 3:00 P.M. to 9:00 P.M, Sunday through Thursday and are supervised by a full-time Admissions staff person.

Due to attrition of the part-time student telecounseling staff, keeping a well-trained, fully staffed telecounseling team required constant attention from management. Scripts used by the telecounselors needed to be frequently updated due to changes at the university and the implementation of new calling projects. The telecounselors performed data entry into the system which generated additional output for the mail room and more follow up from the full-time recruiting staff. Technical support was constantly required to provide needed telecounseling project reports and to respond to system problems.

Management was involved with developing telecounseling calling projects. The special projects included: calling admitted students to promote orientation programs; calling admitted students to encourage interest in on campus housing; contacting potential scholarship candidates; reminding students of fee payment deadlines; and, surveying students who indicated that they had selected another institution. Other ongoing projects included: calls based on ACT/SAT scores, direct mail follow up; contacts to qualify the students' interest in ASU; and, the daily follow up calls to previous mailings and calls.

Mail Room. Undergraduate Admissions has always been inundated with incoming mail from prospective students requesting information about the university. Prior to the new system, Undergraduate Admissions had no way of verifying when (or if) the requested information was sent to students, nor did Undergraduate Admissions send personalized correspondence except in special cases. DIALOGUE™ gave them the opportunity to not only generate a letter for every student requesting information, but also to include specific inserts based on the student's individual needs.

In order for the mailings to be coordinated and smoothly processed each day, Undergraduate Admissions had to

establish a separate mail room where every available insert and mailing piece could be sorted, stocked and stuffed in with the letters as required. Staff needed to be trained in interpreting the "packing lists" produced by the system and found themselves standing at a counter "stuffing" packets for several hours each day. Staff also had to be attentive to the inventory on hand and alert the appropriate department when supplies were running low.

Printing all of the correspondence soon became an issue. Between 500 and 1500 letters were being produced daily. Additional functionality of the new system was not activated due to concern that the existing department printing facilities would not be able to efficiently handle the increased printing requirements. Therefore, Undergraduate Admissions has not been able to utilize some of the features available in the system.

Training. The training function began by primarily concentrating on the telecounseling staff, but eventually spread to everyone in the Undergraduate Admissions office. With more than fifty full-time staff needing to be trained, some at the data entry level, some at the telecounseling level, some with respect to report writing, and some in more technical areas, training became a big project for the department. The department not only did the training, but they also had to prepare the training manuals. Since the system is still going through a period of change, Undergraduate Admissions' internal documentation is continuously needing to be updated and staff re-educated on the changes.

ASSESSMENT

The immediate goal established for the Undergraduate Admissions office was to increase enrollment of out-of-state new freshmen by 200 students. Out-of-state enrollment of new freshmen for the Fall 1992 semester increased by 244. The degree to which the new system contributed to the achievement of this goal has not yet been determined. The Undergraduate Admissions office is in the process of verifying a connection between those students who enrolled and whether or not they were contacted by a telecounselor. This assessment will be ongoing and the lessons learned during this first year will be applied to the recruitment efforts for Fall 1993.

In retrospect, several factors contributed to the success of this project. First, senior management's initiation and support of this project was visible and apparent to all. Getting things done quickly in a large

bureaucracy like ASU is often very difficult. Having the unequivocal support of senior administration greatly facilitates movement through the bureaucratic maze.

Second, the ability of the Undergraduate Admissions office and the Student Information Systems office to coordinate with outside vendors, internal service agencies and academic departments is not something that happens overnight. It depends on prior relationships and networking - knowing who to talk to and how to get the job done.

Third, the ability to install a strategic system in the very short period of time was greatly facilitated by the use of PC and LAN technology. It is unlikely that a mainframe application, even a packaged application like DIALOGUE ™, could have been implemented in less than twenty-six days.

Finally, the willingness of the Undergraduate Admissions staff to accept the challenge and quickly adapt to the enormous change in their routine was essential for this project to succeed. The Undergraduate Admissions staff took the brunt of this "culture shock" and deported themselves in a manner that was above and beyond the call of duty.

Telecounseling is a powerful tool. In addition to being used to recruit students, it can also be used to conduct surveys to identify changes in perceptions and attitudes of students. This information will assist administrators in their efforts to personalize the university experience and respond to changing demands.

NOTES:

[1] FOCUS is a fourth generation language and database management system (4GL/DBMS) and is a registered trademark of Information Builders, Inc.

ATTACHMENT A

HARDWARE

FILESERVER: (1 unit)
- Everex Step 486/33 EISA
- 16 MB RAM
- (2) 676 MB SCSI drives
- Monochrome card and monitor
- 1.44 MB 3.5 floppy drive
- NE2000 twisted pair 16 bit NIC
- American Power Conversion Smart UPS 900

SUPERVISOR'S WORKSTATION: (1 unit)
- HAL-2001 386/25mhz
- 8 MB RAM
- 80 MB hard disk
- Orchid VGA card
- VGA color monitor
- 1.44 MB 3.5 floppy drive
- Internal 2400 baud modem
- HP 5400 DAT 2GB tape backup unit
- 3C503 twisted pair 8 bit NIC

TELECOUNSELOR WORKSTATIONS: (19 units)
- HAL-2001 386/25mhz
- 4 MB RAM
- 40 MB hard disk
- Orchid VGA card
- 1.44 MB 3.5 floppy drive
- 3C503 twisted pair 8 bit NIC

UNDERGRADUATE ADMISSIONS EXISTING WORKSTATION UPGRADES: (6 units)
- Forte/Irma boards
- Memory upgrades to 4 MB RAM
- 3C503 twisted pair 8 bit NIC

SIS FILESERVER UPGRADES:
- American Power Conversion Smart UPS 900
- HP 6400 DAT 2GB tape backup unit
- Memory upgrade to 16 MB RAM
- 676 MB SCSI drive
- 345 MB SCSI drive

PRINTERS:
- Okidata 393 Plus
- (2) HP III LaserJet

ATTACHMENT B

SOFTWARE

COMMUNICATIONS:
- NCSA (TCP/IP for FTP and Telnet)
- Forte (PC789)/Irma (E78)
- CloseUp Remote 3.0

DATABASE MANAGEMENT SYSTEM (DBMS):
- Clarion 2.1

OPERATING SYSTEMS:
- DOS 5.0
- Novell 3.11

GUI:
- Windows 3.1

UPS:
- Powerchute Plus 3.1.4

TAPE BACKUP:
- Syplus 1.21

PRINTING:
- Lanspool 3.0

WORDPROCESSING:
- WordPerfect 5.1

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STUDENT SUPPORT SYSTEMS

M3-1

Mandatory Advising Computer System (MACS) A Way to Improve Communication and Interface Advising with Registration

Linda Burns
Arizona State University

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MANDATORY ADVISING COMPUTER SYSTEM (MACS)

A WAY TO IMPROVE COMMUNICATIONS AND INTERFACE ADVISING WITH REGISTRATION

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Arizona State University believes effective academic advisement is an essential aspect of the student's educational experience. In the spring of 1990, a Mandatory Advising Task Force was organized to assist faculty and staff in meeting their commitment to quality academic advising.

Under the direction of Dr. Kathleen Church, Assistant Vice President for Academic Programs, the Mandatory Advising Computer System (MACS) Project Team was formed to develop an on-line, in-house advising system. The system was to assist advisors track a student's advising and academic history, while providing an electronic advising signoff that could be used by the registration processing.

The Project Team consisted of representatives from each of the colleges, the Registrar's Office, the University Academic Advising Center, and the Intercollegiate Athletic Office. Once the similarities and differences among all of the advising areas were identified, the MACS Project Team was commissioned to develop an on-line advising system that would meet the following objectives:

* Permit each college to control which of its students must be advised prior to registration;

* Provide a uniform format for recording advising sessions;

* Provide a way to record course-related overrides;

* Enforce the advising requirements and the advisor's recommendations during all types of registration: batch registration, on-line registration, and Touch-Tone telephone registration (In-Touch); and

* Control who issues signoffs and overrides.

In February 1991, MACS was brought on-line to be piloted for Fall 1991 registration by the College of Business Administration and the College of Education. Four additional colleges began using MACS in the next semester and the remaining advising areas joined the group for Fall 1992 registration.

WHO USES MACS?

* Colleges use MACS to define groups of students who must be advised prior to registration.

* Advisors use MACS to issue advising signoffs and record course recommendations.

* Faculty members use MACS to issue course-related overrides.

WHY USE MACS?

* By using MACS to define groups of students who need to be advised, colleges ensure students are identified and notified of the advising requirement. Students who are required to be advised cannot register for classes until the advising signoff is issued through MACS. This ensures University and college-related advising policies are enforced.

* By entering course recommendations, advisors document the advising sessions and leave an on-line record that can be viewed by other advisors immediately or in the following semesters. Advisors can choose to enforce course recommendations and control the courses in which a student may enroll for a given semester.

* Issuing overrides through MACS reduces the paper flow and permits students to register for classes through In-Touch. Using MACS in combination with In-Touch reduces the need for the student to come to campus for class registration.

HOW DOES MACS HELP THE ADVISOR?

MACS was designed to offer the following features:

* Provide a history of past advising sessions, which can be viewed on-line at any time.

* Permit advisors to enter notes on-line that can be viewed by other advisors or can serve as reminders for future advising sessions.

* Provide a summary of the student's admission profile. This snapshot is particularly important when working with freshmen.

* Summarize semester and cumulative GPA's. Probation status and academic performance trends can be viewed at a glance.

* List the courses a student has enrolled in for each semester at ASU, along with the grade.

* Highlight athletes and Honors College students.

* Identify professional program status.

WHAT IS THE ADVANTAGE TO ENTERING OVERRIDES ON MACS?

MACS can be used to issue course-related overrides; such as, course restrictions, time conflicts, and capacity limits.

* Overrides issued through MACS can be used by all three types of registration to enroll a student in a class.

* An expiration date can be entered for each override issued, thereby giving the college control over the length of time in which the student may use the override.

* MACS maintains a complete history of overrides issued and used by the student for each semester. It also provides a list of overrides the student needed but did not have when the course was requested.

HOW SECURE IS MACS?

Each advising area has a security administrator who controls update access to MACS. The security administrator determines who may issue advising signoffs for its students and course-related overrides for its courses. These security profiles are built on-line and go into effect immediately.

* Advisors from one college may not issue signoffs for students from another college unless the security administrator has granted permission through an on-line authorization screen.

* Each college may limit override authorization to specific types of overrides, departments, or campuses.

* Once the semester ends, advising signoffs and course overrides for the semester cannot be altered. They become a permanent part of the student's record.

WHAT IMPACT DOES MACS HAVE ON THE STUDENTS?

Students identified as "mandatory advisees" may not register for classes until an advisor has issued a signoff through MACS. This ensures that the student receives direction prior to class scheduling.

* Students who have the MACS signoff may register for classes using batch registration, on-line registration, or In-Touch. This provides the students with options to accommodate their already busy schedules.

* Students who receive course-related overrides issued through MACS do not have to carry a piece of paper to the Registrar's Site to schedule a class. These students may now pick up a phone and schedule these classes at their convenience.

STATISTICS

Fall 1992 registration was the first semester in which all of the advising units used MACS. Of the approximately 44,000 students enrolled in classes for that Fall, over 15,000 students were advised through MACS prior to scheduling classes.

Over 9,000 course-related overrides were issued through MACS and used by students to schedule classes they were not originally able to obtain.

OPERATING ENVIRONMENT

Hardware:	IBM 3090-500E. The mainframe has 128 megabytes of main memory and 128 megabytes of expanded storage. It is logically partitioned into multiple systems via PR/SM. The Administrative partition has 40 megabytes of expanded storage.	
Software:	IDMS	Database management system

ADS/O	Programming language used to develop MACS on-line screens
COBOL/COBOL II	Programming language used to develop batch extract programs and on-line subroutines
EASYTRIEVE PLUS	Programming language used to develop
IDMS-DC	TP monitor used with COBOL II for online registration

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STUDENT SUPPORT SYSTEMS

M4-1

Automating the Housing Process at Florida State University

Danny R. Hawkins
Brian Buckner
Florida State University

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Automating the Housing Process
at
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The University Setting

The Florida State University (FSU) is located in the gently rolling hills of Northern Florida, half-way between the southern border of Georgia and the Gulf of Mexico, in Tallahassee, the capital city of Florida. Tallahassee is not only Florida's capital, but one of its oldest and fastest growing cities, with a population in excess of 175,000. More than 100 state and federal agencies furnish our students with opportunities for internships, research, and work-study programs matching all areas of academic interest. In addition, Tallahassee affords a rich offering of social, cultural, and recreational activities, making it an excellent place in which to live, study, and grow.[1]

FSU is one of nine universities of the State University System of Florida. It was established as the Seminary West of the Suwannee by an act of the Florida Legislature in 1851 and first offered instruction at the postsecondary level in 1857. Its Tallahassee campus has been the site of an institution of higher education longer than any other site in the state. In 1905, the Buckman Act reorganized higher education in the state and designated the Tallahassee school as the Florida Female College. In 1909, it was renamed Florida State College for Women. In 1947, the school returned to co-educational status, and the name was changed to The Florida State University. It has grown from an enrollment of 2,583 in 1946 to an enrollment of 28,512 in the Fall Semester 1992.[2]

An Evolution of Administrative Systems

Prior to 1985, information systems at Florida State were managed by the independent programming staffs of Academic Data Systems, the University Controller, the offices of Business Services and Budget and Analysis, and the Division of Student Affairs. Each of these units had been developing and supporting various computer applications for many years. Some units had made major advances with systems and technology, others had not. While the separate units coordinated projects when there was a major need or an overlap of responsibilities, each unit developed systems pretty much independently and for the specific and individual needs of their users. As a consequence, there was much redundancy of data, as well as effort, and very little integration between the various administrative systems.

Realizing the need for better integrated and more consistent data, and especially a more coordinated and comprehensive view of application design and development, the University Provost combined all of these units into Administrative Information Systems (AIS) in 1985. Prior to this, support for designing and writing a new Housing System had been lost in a maze of "bickering" about resource allocation and project priorities, and the entire application was supported by only .3 FTE. However, as part of the consolidation of IS staffs, the Housing Office and Division of Student Affairs committed additional resources, and AIS and the Housing Office launched a major system develop effort.

Resident Housing at FSU

FSU has approximately 4000 undergraduate students living in 12 residential facilities ranging in capacity from 134 to 574 students, and another 1000 graduate students living in university apartments. Each year, the Housing Office distributes nearly 12,000 applications, of which almost 8000 are returned and processed. Students have available a wide variety of campus living accommodations, options, and preferences, such as 12 on campus dormitories, 8 room types, 6 special programs, 5 visitation options, and may choose up to 3 roommates. Additionally, 4 different payment methods are offered and 18 possible rental rates based on the type of room and building assigned.[3] All housing rental fees are established by The Florida State University and are subject to approval by the Board of Regents. University Housing is a self-supporting auxiliary and rental rates must reflect operating costs.[4]

Doing Things the "Hard Way"

When AIS was established in 1985, Florida State was still essentially performing the resident housing process manually. Two online computer files were available and financial data such as charges and payments were maintained in a revolving keypunch card cabinet.

The Housing Data Base: Once a week, as students were admitted to the university, the Admissions File was referenced to produce labels to mail these students housing application and information packets. As completed housing applications were returned to the Housing Office, they were data-entered into the "Housing Data Base" (actually a keyed-sequential VSAM file). This file was primarily used for rudimentary reporting and to easily view applicant data online. It was not integrated with other university systems or other housing functions. It contained redundant data which was also stored on the Admissions File and the Student Data Base, and keeping the housing data in *sync* with these files required manual notification between offices or by students. Therefore, the "Housing Data Base" usually contained obsolete and inaccurate data and was not very reliable.

The Room Assignment Process: The other online computer file was essentially the "Room Assignments File" and included dormitory names (cryptic abbreviations), room numbers of all available rooms, and social security numbers and names of students assigned to each room (see sample screen on next page). Prior to 1990, determining an assignment was completely a manual process. All 8,000 applications were laid on desks and sorted by first-hall choice. Once this first step was completed, another sort was done based on application date and priority number. The matching of roommates and desired room types followed. Once a hall was filled, remaining students were resorted using their second-hall choice, and the whole process repeated. After all twelve dorms were filled,

the social security numbers, U-boxes (campus mail boxes) and room rates of each student were updated to the *Room Assignments File*. During this manual processing time, responses to student inquires were slow or non-existent because the Housing staff could not determine where, in the over 4,000 rooms, a student was assigned, or even if the student had an assignment.[5] Needless to say, this was a very laborious and time-consuming process, taking 3 employees approximately 3 months to complete.

Sample Screen (Old System)

HOUSING ROOM ASSIGNMENTS

BLDG	ROOM	SOC SEC NUM	STUDENT NAME	UBOX	RATE
CAWT	112A	123456789	SEMINOLE GOOD	1234	425.00
DEVI	106A	299123000	CONFERENCE ACC	1256	375.50
LAND	234	129076459	GATOR BAD BOY	2390	450.00
*	*	*	*	*	*
*	*	*	*	*	*

Processing Charges and Payments: After the *Room Assignments File* was built each term, a batch job was processed punching an IBM card which contained each student's SSN, name, room location, charge type, and room charge. These cards were then interpreted on an old IBM 529 Interpreter (yes, the kind requiring a wired board), sorted by student SSN, and merged on an IBM 085 Collator (again, the kind requiring a board) with other outstanding charges. This combined "Charges File" was placed in file drawers in the Cashier's Office, and each time a charge was paid by a student, the "charge card" was manually pulled and the amount of the payment written on the card. At the end of each day, a keypunch operator would punch the amount of the payment in the card, and the cards were sorted and a proof listing produced on the computer. Corrections were made to the cards and additional proof listings produced until the "cards" balanced with the cash drawer. As each days business was balanced, the reports were kept and the cards collated to produce an end-of-month file and reports. As you can probably guess, cards and reports would get lost or destroyed, and reconciling was a continuous nightmare. Auditors didn't particularly like the process either, and on several occasions recommended that the process be automated. It was these *less-than-favorable* audits that eventually were the catalyst to getting the system rewritten.

A Housing System for the 90s

Like the old system, the new Housing System revolves around three subsystems and files: (1) housing applications and information are still mailed to admitted students and application data is entered into the system; (2) room assignments are now processed via an automated process; and (3) charges are automatically computed and payments processed online and realtime. Additionally, the new system automates many other processes, provides more timely and accurate information, and integrates with other university files such as Admissions, Student Data Base, and Accounts Receivable.

University Master Menu: One major enhancement to the Housing System is its inclusion in the *University Master Menu* and *AIS Security* systems. The Master Menu provides a consistent and reliable method for terminal users to enter online administrative

applications. AIS Security controls User access to specifically authorized screens and data elements. All of FSU's administrative applications will eventually use the Master Menu System, but it has become apparent that many of our users (we like to call them "Power Users") prefer to rapidly move from screen to screen without having to navigate through menus. In order to make our applications more flexible for these users, we are currently piloting a General Transfer System which will allow the entry of a *transfer code* on each screen and automatically *move* to the desired system and screen. (Of course, one must have security clearance defined in the AIS Security System to make such a transfer.)

Another feature of the Master Menu System our users like is the *News* display bulletin. This feature will eventually exist on the master menus of all systems and provide users a method to *flash* notices and information much easier and quicker than sending E-mail, memos, or making phone calls. When using the University Master Menu to move to the Housing System, one enters selection 'B' to receive the Housing Master Menu as seen on page 5.

```
University Master Menu

                 FSU ADMINISTRATIVE INFORMATION SYSTEMS
                       APPLICATIONS MASTER MENU

DEPT SECURITY COORDINATOR:     +------ ++++++ A I S  N E W S ++++++ ------+
NAME : RAY WESTER              |                                          |
PHONE: 644-2495                |  WELCOME TO THE FLORIDA STATE UNIVERSITY |
                               |                                          |
                               |     M A S T E R  M E N U  S Y S T E M    |
   A - STUDENT ACADEMIC        |                                          |
   B - STUDENT AFFAIRS         |            *****     *****               |
   C - STUDENT FINANCIAL       |           **    *   **   **              |
   D - FINANCIAL AID           |           **        **   **              |
   E - PERSONNEL/PAYROLL       |           **  ****  **   **              |
   F - AUXILIARY SYSTEMS       |           **    *   **   **              |
   G - FIN/ACCOUNTING          |            *****     *****               |
   H - ADDRESSES               |                                          |
   I - UNIVERSITY SUPPORT      |  *   **  *****  **      *****    ****    |
                               |  **  **  **   ** **     **      **       |
   X - EXIT MENU               |  * * **  **   ** **     ****    **       |
   Z - EXIT MENU WITH LOGOFF   |  ** * *  **   ** **     **         ***   |
                               |  **  **  **   ** **     **          **   |
ENTER LETTER OF SELECTION: ?   |  **   *  *****  ******  ******    ****   |
                               +------------------------------------------+
PF1: LIST OF APPLICATIONS     PF2 OR PA2: EXIT
```

Housing Master Menu: This menu is the gateway to all Housing files and online functions. From it one may select any of the major subsystems (Student, Assignment, or Fiscal), update their user access password, and broadcast news (if authorized) to all users of the Housing System.

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```
Housing Master Menu
                              THE FLORIDA STATE UNIVERSITY          DATE: 12/10/92
                                  HOUSING MASTER MENU

                                   *********  H O U S I N G   N E W S  ********
A - STUDENT INFORMATION            *                                          *
B - ASSIGNMENT INFORMATION         *              W E L C O M E               *
C - FISCAL INFORMATION             *                                          *
                                   *             T O   T H E   N E W          *
P - UPDATE PASSWORD                *                                          *
                                   *   U N I V E R S I T Y   H O U S I N G    *
U - UPDATE NEWS                    *                                          *
                                   *                 M E N U !                *
                                   *                                          *
                                   * ---------------------------------------- *
                                   *                                          *
                                   * DETAILED MENUS EXIST FOR OPTIONS A -> C. *
SELECTION: ?                       * THESE MENUS, HOWEVER, ARE CONTROLLED VIA *
                                   * THE AIS SECURITY SYSTEM.  TO OBTAIN      *
           PASSWORD: ????????      * AUTHORIZATION TO VIEW THESE MENUS,       *
       NEW PASSWORD: ????????      * CONTACT KEN NIELSEN AT 644-8857.         *
VERIFY NEW PASSWORD: ????????      *                                          *
-------------------------------------------------------------------------------
MESSAGE:  ENTER THE LETTER OF THE DESIRED SELECTION AND PRESS ENTER.
PRESS:    PF1=HELP, PF2=AIS MENU, PF3=SA MENU, PF5=NAME BROWSE.
```

The Student Information Subsystem: Accessed via menu selection 'A' from the Housing Master Menu, this screen provides an opportunity to input, update, cancel, and reinstate housing applications; view application information; review a student's housing activity history; and update information such as student name, SSN, and permanent address. As can be seen, several functions are available. For instance, selection 'SA' presents the Student Information Inquiry screen.

```
Student Information Subsystem Menu
                           THE FLORIDA STATE UNIVERSITY          DATE: 12/10/92
                         HOUSING STUDENT INFORMATION MENU

APPLICATIONS:                STUDENT INFO:              CHANGE FUNCTIONS:
AA - ADD                     SA - INQUIRY/UPDATE        CA - NAME
AB - INQUIRY/UPDATE          SB - HISTORY               CB - SSN
AC - CANCEL  (N/A)                                      CC - PERMANENT ADDRESS
AD - REINSTATE  (N/A)

SELECTION: ??                 SSN: ??? ?? ????     NAME: ?????????????????????????
                             TERM: ?      YEAR: ??
-------------------------------------------------------------------------------
MESSAGE:  ENTER THE LETTER OF THE DESIRED SELECTION AND PRESS ENTER.
PRESS:    PF1=HELP, PF2=AIS MENU, PF3=HSG MENU, PF5=NAME BROWSE.
```

Student Information Inquiry: This is the basic information screen for students in university housing. The student's SSN is the primary key to the file and also links the Housing System to other university files. For instance, name, birth date, sex, and permanent address are retrieved from either the Admissions File, Student Data Base, or Centralized Address File. The other data is entered by the Housing Office or retrieved from other housing files such as the Room Assignments File. An interesting aid for Housing staff is the ability of the system to display certain informational messages such as ENROLLED IN HONORS.

Other data which is collected in the housing application and university admissions process and which is available on six other screens includes: Handicap Information; Smoking Preference; Music Practice; Special Housing Options such as Prepaid College, Honors, or Genesis; Visitation Preference; Air Conditioner Need; Preference Ranking of Hall/Floor/Room, Roommate, and Room Type; Dormitory Choices; Room Type Preferences; and Roommate Preferences. The History Screen (selection 'SB' on the Student Information Subsystem Menu) provides a chronological history of each transaction processed for each housing student. The CHANGE FUNCTIONS provide a consistent and easy manner to update names and addresses and change SSNs. These functions actually link to, and update, other university files in order to keep files in sync and eliminate the need for redundant data.

```
Student Information Inquiry
                 STUDENT INFORMATION - INQUIRY

      SSN: 589 99 9999      NAME: SEMINOLE GOOD GUY

BIRTHDATE: 06 30 74      PRIVACY: N            PERMANENT ADDRESS:
                                               499 WALKER AVE
      SEX: M             TYPE: S - STUDENT     TALLAHASSEE       FL 32399
                                               ( 904 )  321-8977
ENROLLED IN HONORS

APPLICATION INFORMATION:                                         REJECT: N
INITIAL APPL:        TERM: 9 92    DATE: 07 07 92    PRIORITY: 3514
FALL/SPRING RENEW:   TERM: 1 93    DATE: 11 29 92                  TYPE:
SUMMER RENEW:        TERM:         DATE:                           TYPE:

HOUSING ASSIGNMENT FOR 1/93:            0312 BROWARD HALL
                                        U-BOX 66376
                                        ( 904 )  853 - 1719
---------------------------------------------------------------------------
MESSAGE:  INQUIRY COMPLETE - PRESS PF6 TO UPDATE OR PF9 TO DELETE.
PRESS:    PF1=HELP, PF2=AIS MENU, PF3=SI MENU, PF4=HSG MENU, PF5=NAME BROWSE.
```

Room Assignments Subsystem: This subsystem provides eleven screens to perform four basic functions: (1) add, change, or delete a student's assignment online or to browse the Room Assignment File; (2) update the Room Assignment File with new buildings and rooms; (3) update room rates; and (4) update, activate, deactivate, and assign campus post office boxes. An example of the Room Assignment Browse screen follows at the bottom of the page.

```
Room Assignments Subsystem Menu
                      THE FLORIDA STATE UNIVERSITY            DATE: 12/10/92
                      HOUSING ROOM ASSIGNMENT MENU

ASSIGNMENTS:                ROOMS/APTS:               U-BOXES:
AA - BROWSE                 BA - ADD (N/A)            UA - ADD
AB - INQUIRY                BB - BROWSE               UB - ACTIVATE
AC - MAKE ASSIGNMENTS          - CHANGE INFORMATION      - BROWSE
   - REMOVE ASSIGNMENTS        - DELETE                  - MAKE ASSIGNMENT
   - UPDATE DATES           BC - MAINTENANCE (N/A)       - REMOVE ASSIGNMENT
AD - MOVE REQUESTS (N/A)    BD - HISTORY (N/A)        UC - STOP CANCELLATION
AE - CHECK IN (N/A)         BE - STATISTICS (N/A)     UD - DELETE
AF - IN HALL MOVES (N/A)
AG - NO SHOWS (N/A)         ROOM RATES:               SPECIAL FUNCTIONS:
AH - INTENT TO VACATE (N/A) RA - ADD                  SA - ASSIGNMENT TERMS
AI - CHECK OUT (N/A)        RB - BROWSE
                               - DELETE
                               - UPDATE AMOUNTS

SELECTION: ??              TERM: ?     BLDG: ????     ROOM: ????
                            SSN: ??? ?? ????     NAME: ???????????????????????
                          U-BOX: ????
-----------------------------------------------------------------------------
MESSAGE:  ENTER THE LETTER OF THE DESIRED SELECTION AND PRESS ENTER.
PRESS:    PF1=HELP, PF2=AIS MENU, PF3=HSG MENU, PF5=NAME BROWSE.
```

```
Room Assignments Browse
                               ASSIGNMENTS - BROWSE

          TERM: 9       BLDG: LAND      ROOM NUM: 0404      BED: B
-----------------------------------------------------------------------------
 BUILDING KEY   SOC SEC NUM      STUDENT NAME      TYPE SEX  RATE    PHONE   UBOX
9 LAND 0343 B   999-28-1922  SEMINOLE JOHN Q        DBL  M   899.00 853-2719 0423
9 LAND 0344 A   999-72-9003  SMITH MARY JANE        DBL  M  1040.00 853-3699 3202
9 LAND 0344 B   999-55-8644  COLLEGE JOE EDWARD     DBL  M  1040.00 853-3699 0511
9 LAND 0345 A   999-36-4226  APPLETON CRABBY J      DWB  M  1195.00 853-1893 0184
9 LAND 0345 B   999-24-7738  HAWKINS DANNY R        DWB  M  1195.00 853-1893 0883
-----------------------------------------------------------------------------
MESSAGE:  PRESS PF7=PAGE UP, PF8=PAGE DOWN.
PRESS:    PF1=HELP, PF2=AIS MENU, PF3=AI MENU, PF4=HSG MENU, PF5=NAME BROWSE.
```

Fiscal Information Subsystem: This subsystem provides thirteen screens to process and display data related to charges, payments, and deferments. As can be seen from the Housing Fiscal Menu, there are several different functions available to process payments. Charges are generally generated automatically by procedures such as the Automated Assignment or Late Fee Processes, but charges can be manually entered.

```
Fiscal Information Subsystem Menu
                          THE FLORIDA STATE UNIVERSITY          DATE: 12/10/92
                            HOUSING FISCAL MENU

ADV PAYMENTS              CHARGES:                   MONTHLY F/A DEFERMENTS:
AA - ADD                  CA - ADD                   FA - ADD
AB - APPLY                CB - BROWSE                FB - ADJUST
   - BACK OUT             CC - ADJUST                   - BROWSE
   - BROWSE                  - CANCEL                   - DELETE
   - FORFEIT                 - CHANGE FLAGS             - UPDATE
   - REFUND                  - CHANGE DEFER CODE
                             - DELETE                SPECIAL FUNCTIONS:
PAYMENTS:                    - REINSTATE             SA - ADD TERMS
PA - ADD                                             SB - BROWSE/UPDATE TERMS
PB - BROWSE               CHARGE CODES:              SC - RECEIPT LOCK
PC - CHANGE PYMT CODE     BA - ADD (N/A)
   - CHANGE APPLY MM/YY   BB - BROWSE (N/A)
   - DELETE               BC - UPDATE (N/A)
   - REINSTATE FORFEITS

SELECTION: ??               SSN: ??? ?? ????       NAME: ????????????????????
                            TERM: ?      YEAR: ??
--------------------------------------------------------------------------------
MESSAGE:  ENTER THE LETTER OF THE DESIRED SELECTION AND PRESS ENTER.
PRESS:    PF1=HELP, PF2=AIS MENU, PF3=HSG MENU, PF5=NAME BROWSE.
```

```
Charges Browse
                               CHARGES - BROWSE

SSN: 999 05 8410          NAME: COLLEGE JOE MAJOR            TERM/YEAR:

MODES: X - DETAIL INFORMATION                 COMPLETE BALANCE DUE:  1040.00
--------------------------------------------------------------------------------
M   TERM   CHG DATE   SEQ NUM    CHG AMT    BAL DUE    PD AMT    DESCRIPTION
    9/92   08/16/92   HU 00318   1040.00       0.00   1040.00    DORM RENT
    9/92       TERM   TOTALS:    1040.00       0.00   1040.00

    1/93   01/04/93   HU 02521   1040.00    1040.00      0.00    DORM RENT
    1/93       TERM   TOTALS:    1040.00    1040.00      0.00

--------------------------------------------------------------------------------
MESSAGE:  >>> END OF REQUESTED DATA! <<<  PRESS PF7=PAGE UP, PF6=CHRG UPDATE.
PRESS:    PF1=HELP, PF2=AIS MENU, PF3=FI MENU, PF4=HSG MENU, PF5=NAME BROWSE.
```

```
Payments Browse
                                   PAYMENTS - BROWSE

SSN: 999 05 8410          NAME: COLLEGE JOE MAJOR           TERM/YEAR:

MODES: X - DETAIL INFORMATION
--------------------------------------------------------------------------
        CHARGE     PAID     ORIG   TRNSFER               PAID    DIS
M TERM   DATE      DATE     RCPT    RCPT     BUDGET       AMT    NUM  DESCRIPTION
  9/92 08/16/92  03/02/92  092062          722700062   225.00    01 DORM RENT
  9/92 08/16/92  06/23/92  092175          722700062   815.00    01 DORM RENT
  9/92      TERM TOTALS:                               1040.00

--------------------------------------------------------------------------
MESSAGE:  >>> END OF REQUESTED DATA! <<<  PRESS PF7=PAGE UP, PF6=UPDT PAYMENTS.
PRESS:    PF1=HELP, PF2=AIS MENU, PF3=FI MENU, PF4=HSG MENU, PF5=NAME BROWSE.
```

Automating Housing Assignments

The most exciting new function available in the new Housing System is the *Automated Assignment Process*. It consists of two components which are run in batch. The first component is used to create the assignment order and the second is used to search through dormitories looking for the assignment that best meets a given student's needs and preferences.

Creating the Assignment Order: The first step in creating the assignment order is to determine if the student is in any *Special Programs*. This information is located on the Housing Application, Admissions, and Student Data Base files. Special Programs include: Honors and Scholars, Florida Pre-Paid College Plan, Genesis, and Transfer Students. Each of these Special Programs are located in designated dorms and rooms. This first step ensures a *Special Programs* student will be assigned a room in the proper area.

The program next examines roommate requests. Each student may request up to three roommates. In order to be assigned with requested roommates, all parties need to request each other, and must agree that roommate preference is the highest priority preference. The program also checks to see if all parties are in agreement concerning visitation and air conditioning preferences. Roommate requests that do not properly match are printed on an error report and resolved by the Housing staff.

The final step includes sorting students in application date and priority number sequence. The earlier an application is received, the higher the priority will be. However, exceptions to this sequence are allowed. For instance, Honors students are always assigned first, and roommates who request each other are sorted using the most recent application date and lowest priority number.

Assigning Rooms: If a student requested a roommate, the program first determines if the roommate has been assigned a room. If so, the student is immediately assigned to the same room. If the roommate has not been assigned, the program finds the best possible assignment using the process described in the following paragraph.

To make the best possible assignment, the program first looks at the student's dorm choice and determines if it meets the air conditioning preference. If not, the next dorm is searched. If the air conditioning preference is matched, the program searches for rooms with the desired room type. Once found, the program searches for a match on visitation preference. Students are only assigned to a room if the dorm and floor matches the visitation preference.

Once a room is found meeting all the student's preferences, the program checks to see if the room is already assigned. If not, the assignment is made. Otherwise, more checks are made to ensure the roommates are compatible. The roommate matching criteria includes questions about smoking preferences, wake up times, and study habits. If all criteria match, the student is assigned. If students are not completely compatible, the program again begins the search for the best room assignment. If no other rooms are found in the desired dorm, partial compatibility is checked. However, smoking preferences must match. Smokers will not be assigned rooms with non-smokers. This process is followed for each of a student's four dorm choices. If no room is available in any of the requested dorms, the program searches down a list of the most desired dorms on campus. Again, an attempt is made to find the best possible assignment given a student's preferences and requests. Once the assignment is made, the student's name, SSN, move-in-date, move-out-date, U-box, and room rate are automatically updated to the Room Assignment File and a transaction log record is generated to the History File.

The *Automated Assignment Process* has been a huge success for both students and Housing Office staff. Students find out much sooner what their assignment is and who their roommates are. The Housing staff doesn't spend months manually assigning rooms and are available to spend more time with students who have special problems.

Future Enhancements

Most of FSU's housing students are undergraduates and the new Housing System is targeted primarily at them. Maintaining the operation of 996 graduate apartments with thirty day leases continues to be a strain and presently requires a huge amount of paperwork. Design work has been completed and automating this process is being planned. In the future, automated check-in procedures will initiate rent, produce a copy of the key receipt, update the Room Assignment File, produce a housing account balance statement, and update the Student Data Base. Future check-out procedures will stop rent and calculate a prorated balance, notify staff of apartments available for inspection and reassignment, and update the Student Data Base.

Another major effort will move some housing operations out into the dormitories providing easier access for students. Presently, students must come to the Central Office to request room changes, submit applications for future terms, and verify account balances. They must also visit other offices such as the Registrar, Controller, Financial Aid, etc. to take care of various business. The University is considering an expansion of its *Self-Inquiry System* and development of Windows-based GUI interfaces to include many of these functions.

Conclusion

The new Housing System has made life much easier for the Housing Office and students, and saves hundreds of man-hours a year. Data is much more reliable and *information* is more available to make informed decisions. Excellent fiscal controls are now in place and the latest business audit produced **zero** criticisms.

"Caring and Sharing" is the motto of the Division of Student Affairs. This project demonstrates that a major development effort can be successful when this motto and a *team* effort are applied.

FOOTNOTES

[1] *General Bulletin*, The Florida State University, 1991-1992, page 9.

[2] *Florida State University Facts*, Institutional Research Section, Budget and Analysis, Fall 1992.

[3] Burig, Bill, ACUHO-I Article, *An Exploration of Housing Automated Systems at Florida State University*, September, 1992.

[4] *General Bulletin*, The Florida State University, 1991-1992, page 43.

[5] Burig, Bill and Nielsen, Ken, *Computerized Room Assignments and Information Management - Seminole Style*, presentation, 1992 SEAHO Conference, Memphis, Tennessee.

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INFORMATION TECHNOLOGY: The Revolution Continues

STUDENT SUPPORT SYSTEMS

T2-1

Providing Students Critical Academic Planning Assistance Using Academic Information Management (AIM): A Remote Access Program

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38th Annual
College and University
Computer Users Conference

Hosted bv Baylor University
in San Antonio

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PROVIDING STUDENTS CRITICAL ACADEMIC PLANNING ASSISTANCE USING ACADEMIC INFORMATION MANAGEMENT (AIM): A REMOTE ACCESS PROGRAM

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The delicate balance between using technology and providing people-oriented services is a constant challenge to student academic support units on the campus. Certainly the use of technology to relieve clerical burdens and enable people to be more student-centered satisfies the mission of college student services. Just as important, timing or delivery of academic planning information is critical to students, faculty, and professional advisors. Thus the ideal blend is to use machines to provide the timely distribution of information and allow academic support/services personnel to assist students individually beyond the routine. Academic Information Management (AIM), as described in this paper, embodies the following three elements: (1) providing students critical academic planning information **when they need it**, (2) **assessing** and providing **access** to student academic information for the academic community, and (3) freeing people to individualize services. In short, AIM's purpose is to effectively distribute academic planning information to student and faculty colleagues.

AIM'S DEVELOPMENT AND PRECURSORS

For several years at BYU, students (via paper) and faculty/professional advisors (via terminal) have received an Advisement by Computer (ABC) report each semester. Generally, these reports are made available at the beginning of the semester to (1) verify current registration and (2) provide academic planning information for a subsequent semester. The ABC report, implemented in 1979, provides students and advisors access to current curriculum degree requirements.

Advisement by Computer (ABC)

The ABC system provides the user with immediate and direct access to the curriculum degree requirements and student academic records. The user can generate an individual progress report on request. When the student's name or social security number is entered, the computer program locates the student's academic record, matches it with the degree requirements for the semester the student officially entered the degree program, and displays the results on the terminal screen in two to three seconds. If a hard-copy record is desired, the

request is entered in the computer and the report is printed immediately. ABC progress reports are mailed to students each term of their enrollment.

The format and features of the ABC report are divided into the following three sections: (1) university graduation requirements, (2) major requirements, and (3) current enrollment and unofficial transcript. Each of these sections is described below.

University Graduation Requirements

This section contains biographical information (the student's name, address, college, major, and expected graduation date) and university graduation requirements (including general education requirements). In addition to listing the number and hours of required classes and the classes completed, this portion indicates remaining deficiencies and lists current classes that will fill them.

Major Requirements

This section lists the requirements for the student's declared major. It contains biographical information (including the term in which the student declared his or her major) and the requirements of the major (grouped in a logical sequence recommended by the department). The required courses are listed on the left, followed by what classes were used to complete the requirements, the grade received and number of credit hours for each class. If the department has authorized waivers, substitutions, or transfer equivalencies, these are also shown. Text information may be added to the course groups or placed at the top of this section. The address and phone number of the college advisement center as well as the name of the assigned faculty advisor are always included as the last entry of this section.

Current Enrollment and Unofficial Transcript

This section is divided into two parts: (1) current enrollment and (2) an unofficial transcript. The current enrollment serves as a verification of the student's registration, because listing the class title, section number, and credit hours are listed for each class. The unofficial transcript lists all courses the student has completed at BYU or elsewhere. A semester GPA is given for each semester completed at BYU, as well as a summary of credits listing overall GPA and BYU GPA.

Summary of Features

The computer-assisted advisement report

*States graduation requirements and tracks course completion and deficiencies.
*Categorizes requirements within the major (college, department, major, and emphasis).
*Individually tailors and tracks an approved degree program.
*Tracks major requirements in groups by class, semester hours, and various combinations.
*Shows narrative information as needed.
*Includes all institutional, transfer, and other credit such as (AP, CLEP, or military).
*Tracks changes in major requirements as often as every semester.
*Maintains each student's major requirements based on the date of entry into the major.
*Shows substitution courses, waivers, and transfer equivalencies.
*Applies current enrollment to graduation requirements.
*Indicates courses that have been repeated.
*Distinguishes between acceptable and unacceptable grades.

In summary, the advisement by computer report provides various advantages for the student, advisor, and institution:

THE STUDENT:
Convenient access to critical planning information, accurate information, immediate feedback, and a sense of control in academic planning.

THE ADVISOR:
Reduces time in evaluating students for graduation, improves accuracy of advisement, simplifies obtaining information on academic requirements, and makes up-to-date information readily available.

THE INSTITUTION:
Provides clerical relief, professionalizes the advising program, supports cost effective resource management, and deemphasizes bureaucratic tendencies of an institution.

Touch-Tone Telephone Registration

Another aspect of AIM's development includes BYU's touch-tone telephone (TTT) registration system, implemented in 1986. TTT registration continues to be a very successful program because (1) almost everyone in the country has access to a TTT, and (2) it gives simple, direct access to the university's registration system. It has proven to be very popular, but is limited to the telephone keypad. A few years ago, we developed a series of TTT programs like those available in TP (terminal process) form for financial aid, admissions, and advisement. But we disbanded our work because it became obvious that the interaction between user and machine would be much too cumbersome. We literally developed pages of instructions and TTT dialogue that guided the user through such programs as fulfillment of general education requirements, address/phone change, grades and BYU credit, and major shopping.

Both technologies--ABC reports and TTT registration have played a critical role in the development of student information management. Their success contributed to the expansion and accessibility of information in a new and combined program known on our campus as Academic Information Management (AIM). It was a natural evolution. Perhaps it would have been possible to develop AIM initially or essentially bypass these earlier developments. However, previous experience and critical work already in place paved the way for a smooth and successful transition to a new dimension of delivering student academic planning information. Clearly, what we know about student information systems in 1993 is much different than it was in 1978!

College Advisement Centers(CAC)

College Advisement Centers (CAC) like the ABC and TTT, also became an important forerunner to the successful implementation of AIM. Advisors are usually the first and most consistent contact between students and the institution. Within the advisor's office, students and the system often meet face-to-face. Here is where advisement center personnel encourage students to experiment with AIM and finally integrate this new program into the advisement system.

Since CACs play an integral and collaborative role with BYU's current programs in TTT and ABC, it was only natural that they should intertwine with AIM. In the context of developing AIM, advisors who are in the unique position to represent the institution to the student, as well as represent the student to the institution, became a critical sounding board. Because CACs profoundly influence the success of technical programs like AIM, it may be helpful to outline their role in the institution. The personnel who staff these CACs represent the delicate balance between the use of technology and providing people-oriented services.

The CAC is an academic information resource for students. The center maintains up-to-date records of all students in the college, provides information on its academic programs, and distributes administrative forms for adding and dropping classes or changing a major. Every center maintains computer access to a variety of student information, including new student admissions profiles, ACT data, transfer equivalencies, up-to-date academic records, and degree audit reports. In general, the CAC is a place where a student can receive on-line information from someone who has been trained in the use of advisement data.

University Advising Core

The centralized-coordinated/decentralized-operated organization of academic advisement in the university, administered by the Office of Academic Advisement, ensures a campus-wide quality program, while allowing colleges to address the unique advising needs of students. Each CAC provides the following standard university advising functions:

1. **Academic advising for the college.** CAC personnel, available daily between 8:00 a.m. and 5:00 p.m., provide services either by appointment or on a drop-in basis.
2. **Advising file.** Each CAC has access to on-line student data (ABC report, high school data, registration/scheduling screens, transcripts and transfers data).
3. **Evaluation of transfer credit.** CACs assist in the evaluation of new and unique transfer credit from institutions.
4. **New student orientation.** Each CAC supervisor plans and coordinates the college's new student orientation program in conjunction with the overall university program.
5. **Degree profiles.** Each CAC maintains and publishes degree requirement profiles for each major or emphasis within the college.
6. **Faculty advising.** CACs coordinate, with department chairs, the assignment of faculty advisors to students.
7. **Registration assistance.** CAC personnel provide registration assistance and advice to currently enrolled students within their college as well as for new incoming students.
8. **Graduation clearance.** Working closely with the Office of Graduation Evaluation, CACs review all potential candidates for graduation. CAC personnel work closely with department chairs to clear a student's completion of major requirements.
9. **Referrals and appointments.** Since some student questions are not addressable by a CAC and CAC personnel are familiar with other campus services, they often collaborate with other faculty or simply refer the student to the appropriate service.

10. **Academic assistance seminars.** CACs coordinate a variety of seminars relative to the interest and academic needs of the students and the college.

In summary, CACs provide personalized advising services by helping students plan their educational program consistent with their interests, abilities, and academic goals. To accomplish this end, advisement centers provide an advisement core that offers a wide range of services to students.

THE FIRST YEAR EXPERIMENT

After incorporating the features of student academic information of TTT, ABC, and CACs, our aim became twofold: (1) provide students better and timely access to their individual record and (2) refine or make more user-friendly existing TP programs--primarily those used by faculty and staff--for student use. We selected five of eleven college advisement centers to participate in the experiment.

On a weekly basis for a semester, our computer programmer and Registrar and Director of Registration met with personnel in the CACs to (1) devise ways and means to study the affects of the AIM program, (2) resolve hardware and software (remote access) matters, (3) discuss security measures, (4) refine current academic information TP screens to make them relevant and useable AIM menu items, (5) decide where AIM terminals should be located, and (6) strategize our communication to students and faculty about the availability of the AIM system in the five experimental stations. These meetings laid the groundwork for the following materials and programs used in the experiment: The Academic Information Management Questionnaire, Users Guide, and AIM Flyer and Poster (see Figures 1-3).

THE SECOND YEAR EXPERIMENT

Based on the very positive results obtained from advisors and students who used AIM during the second semester of the first year experiment, several changes were implemented during the second year. First, many of the menu items were either enhanced or rewritten while other items were added (e.g., transfer work and grades). Second, we eliminated the User Directory. Due to changes and enhancements in programming, we were able to cross-reference many of the items in the Directory. In all other cases, we simply included instructions as a "help" screen for each menu item. In other words, we made AIM a navigable program by simplifying, cross-referencing, and integrating most of its features. Third, expanded options and success forced us to expand AIM locations. AIM is now available in several on-campus housing areas, all advisement centers, the student union building, and in counseling and development offices.

THE AIM PROGRAM AND CURRENT FEATURES

The overall purpose of AIM is to help students answer minor questions about their academic progress. AIM answers a variety of students' academic progress questions, when students need answers. It provides timely and convenient access to important and individual academic information. As discussed above, ABC reports and TTT are good technologies but are not sufficient especially for a dynamic, multiple-optioned and complex environment of delivering student academic data to the campus community. The trend in technology seems very much to be one of optimizing user and machine interface. For example, the TTT cannot effectively allow users to register by need or interest. It simply would take too much time or be extremely cumbersome. Yet by interacting with AIM menu items, a user can enroll in courses by **instructor** or **requirement deficiency**. If a course is full for the upcoming semester, the user can identify **when** the course will be taught in the academic year or when the desired instructor will teach the needed course again. In fact, by using AIM, the user can register six different ways by using the following menu items: (1) academic progress for major requirements, (2) instructor teaching schedules, (3) the class schedule--locating specific classes by time or searching the current class schedule, (4) major shopping, (5) general education progress, and (6) direct registration screen (similar to TTT).

AIM provides the user with a **visual** exploration of and dynamic interaction with the university's student information system. Once the user's social security number and personal identification number are entered, an array of information services becomes available. Users can concentrate on academic records with AIM. Students can call up their current academic record instantly. Menu options include the following:

* address and phone changes
* the university and personal class schedule by semester or term
* course availability for the academic year
* general education and major progress (ABC)
* grades and BYU credit earned
* instructor schedules
* options within a major (shopping for a major interactively and dynamically)
* PIN changes and registration
* transfer and AP credit/grades
* individual demographic information

Simply put, AIM takes the pressure off advisement centers and faculty members who used to have to repeat mundane and routine data for students. Students can access the data themselves and then seek for advice from professional staff and faculty members.

THE FUTURE OF AIM

Like all technical programs designed to serve the academic community, they quickly become outdated with emerging technology. The computer environment clearly continues to change the way we think about and do our work. AIM is no exception to the computer revolution. It's a composite as well as a by-product of past efforts. Although AIM is not a finished concept, it is nevertheless an attempt to capitalize on the computer industry's direction in distributing information to others. As hardware and software become more sophisticated, paralleled by significant costs in the industry, institutions in general and AIM specifically will continue to be challenged to incorporate new technological advances.

What's on the horizon for AIM? We see at least three hopes for the future. First, we hope that AIM can be expanded to off-campus users via modem. Like the TTT of the 1980s, computers with a modem punctuate the homes of the 1990s. We envision soon the opportunity for students via their personal computer (with modem), to gain access to the current services of AIM. Certain obvious security measures create a disadvantage here, since current access to AIM is through a mainframe environment. Much of this concern, however, will be resolved through a distributive or open computer system.

Second, we hope soon to include access to AIM for transfer students from major feeder schools. Ethernet is the key link here. At present, we can transmit both admission data and historical records wholesale from these schools. Since this work is going well, we hope soon to provide individual access to AIM to feeder schools.

Finally, we hope not only to expand the number of AIM terminals on campus, but also to substantially increase access to other information needs of the campus community. For example, it is our intent to expand AIM to all campus living units as well as to the library and other key places on campus. Expansion of AIM's menu in the future will most likely include (1) Cooperative Education locations and contacts; (2) Career Planning and Placement services. such as an announcement for registration of campus visits by prospective employers; (3) daily, weekly, and monthly campus events; and (4) university deadlines such as drop/add, graduation application, and tuition payment. Within this environment, it is hoped to electronically create mailboxes for students and faculty alike. For example, we could potentially eliminate the costly distribution of ABC reports by promoting the use of AIM's menu on academic progress information. Other information items that could be passed electronically to student mailboxes include notifying students of academic "holds" in the university or a message to apply for graduation.

CONCLUSION

Dreams are simply goals with deadlines. Who knows our limits? Perhaps it is time to try something new and take a chance. Although most institutional student records management or student information systems are running smoothly, Burt Nanus observed that leadership in any field is really all about fixing things that aren't broken! So perhaps it's appropriate to ask "What's next, and why?" AIM has stimulated our imagination; the possibilities may be nearly endless.

Academic Information Management

QUESTIONNAIRE

Help!

Please help us to refine this program by answering the following questions. Circle your answers.

	Disagree				Agree
1. I didn't have any problems using the system.	1	2	3	4	5
2. Written instructions were clear and easy to understand.	1	2	3	4	5
3. Written instructions were helpful in guiding me from one screen to another.	1	2	3	4	5
4. The menu titles were an accurate description of the information in that category.	1	2	3	4	5
5. I was able to understand the information displayed on the screens.	1	2	3	4	5
6. The menu gave me access to all the information I wanted.	1	2	3	4	5
7. I am confident the computer has correctly recorded all my update changes.	1	2	3	4	5
8. I would use the system again.	1	2	3	4	5

	I used these screens:	I printed these screens:
Address/Phone Change	☐	☐
Class Schedule	☐	☐
Course Availability	☐	☐
Grades and BYU Credit	☐	☐
GE Progress (ABC)	☐	☐
Individual Information (Biographical)	☐	☐
Major Progress (ABC)	☐	☐
Major Shopping	☐	☐
PIN Change	☐	☐
Registration	☐	☐
Transfer and AP Credit/Grades	☐	☐

Note: If you experienced any problems or frustrations, or if there is information you would like added to the menu, please comment.

Academic Information Management

OPERATOR'S MANUAL

Welcome
to the
ACADEMIC
INFORMATION
MANAGEMENT
Program
(AIM)

Instructions

Please follow the steps below in sequence. If you get stuck, ask advisement center personnel for help.

1. Type your BYU ID (usually your social security number).
2. Type your personal identification number (PIN) and press ENTER.

   Your PIN is the same as that used for Touch-tone registration.

   Please feel free to change your PIN at least annually. For instructions see menu item 9.

After use, be sure you exit the system properly to maintain the confidentiality of your records.

MENU

1. Address/Phone Change
2. Class Schedule
3. Course Availability
4. Grades and BYU Credit
5. GE Progress (ABC)
6. Individual Information (Biographical, etc.)
7. Major Progress (ABC)
8. Major Shopping
9. PIN Change
10. Registration
11. Transfer and AP Credit/Grades
12. Exit

AIM

Students in your college can now call up their current academic records instantly AIM (Academic Information Management), an exciting new software system sponsored by Academic Advisement, allows students instant access to such information as—

- ADDRESS AND PHONE CHANGES
- APPLYING FOR GRADUATION
- CLASS SCHEDULES
- COURSE AVAILABILITIES
- GE AND MAJOR PROGRESS (ABC)
- GRADES AND BYU CREDIT
- INSTRUCTOR SCHEDULES
- MAJOR AND MINOR OPTIONS
- PIN CHANGES
- REGISTRATION
- TRANSFER AND AP CREDIT/GRADES

Designated AIM computers are in your college advisement center, in on-campus housing, and at the ELWC Information Desk. Encourage your students to use them to check their records, update them, get print-outs, and weigh alternatives—without waiting. **AIM FOR SUCCESS.**

ON-CAMPUS HOUSING LOCATIONS: (1) MORRIS CENTER COMPUTER LAB, (2) CANNON CENTER CENTRAL LOBBY, (3) HERITAGE HALLS CENTRAL BUILDING LOBBY, AND (4) WYMOUNT COMPUTER LAB.

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BAYLOR UNIVERSITY '93
San Antonio

INFORMATION TECHNOLOGY: The Revolution Continues

STUDENT SUPPORT SYSTEMS

T4-1

New Technology Drives New Technology! (In Housing and Food Service)

Donna F. Young
Purdue University

38th Annual
College and University
Computer Users Conference

Hosted by Baylor University
in San Antonio

May 9–12, 1993

New Technology Drives New Technology!
(In Housing and Food Services)

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In the information systems business we seldom spend a single day without learning about the "latest" technological advances in hardware and software to enhance or build computerized systems. Already this month the newer and better is being replaced by the newest and best! There are numerous paths that we can follow. As the visual portrays, we can barely see the forest for the trees (new technology) let alone the right path to follow!

Often when computerization experts experience new technology overload, their tendency is to lean on the familiar - the tried and true. The same may be said of their clients who often follow their lead. Of course there are some who "strike out" on their own path!

Just as change for the sake of change is not always advantageous, new technology for the sake of new technology is not always beneficial. On a positive note, it appears the trend today is toward <u>new technology driving new technology</u>. This gives clients the option to pick and choose at will to suit their business needs. Change no longer need be viewed as a byproduct of new technology.

For this presentation, let's examine what happened at one public university during the 1980's and early 1990's as technology relentlessly advanced. At the West Lafayette, Indiana campus of Purdue University, the Administrative Data Processing Center (ADPC) develops and maintains a variety of systems, most of which run on the mainframe. These systems support the departments who run the business of the university. Among these departments are admissions, collections, continuing education, housing and food service, food stores, and registrar. These business areas are diverse yet all connected by the customer they ultimately serve.

During this presentation, we will be considering the Housing Accommodations Management and Dining Service Management department. While **customer** refers to the customer of the university which is most likely the student, the department is referred to as the **client** of ADPC. The visual aids used are not included in the proceedings; most visual aids are included in the presentation, and a few (such as forms and reference guides) are available for review following the presentation.

In the early 80's, ADPC (and some of its clients) often tried to drive new technology by business needs. For instance, the data entry area for many of the departments at Purdue University resided within ADPC. This was moved to the "point of entry" or the business area in the university to better service the customer. To do so, necessary technology had to be made available. In the client area, that technology consisted of a "dumb" terminal attached to a telephone cable. The data resided in a repository for overnight processing. These customer data entry systems had online inquiry but not update. Not so much later, university business demanded real time inquiry and update to satisfy the need for up-to-date information, and the client soon began requesting access to data for their reporting needs. Various methods for accessing the data for reporting were tried. Many failed while most required the use of "sneaker net" or carrying the data from ADPC to the department on a floppy diskette. The business was trying and, for the most part, failing to drive technology.

Not much later, when the Personal Computer (PC) arrived on the scene, many felt the inclination to allow new technology to "set the stage" for business based on what the PC software and hardware could provide. To some degree this succeeded as PC memory, printers, and software capabilites satisfied some needs of the business area. Many PC based systems were developed and implemented in the client areas by their own computerization experts. A variety of "homespun" systems came into being, most without documentation when the creator left the scene. Furthermore, the operation of each client was often limited to the type of technology being used. Since this technology was changing rapidly, these clients were also faced with the challenge of integrating the new and old technology. Some attempt was made by ADPC to standardize the purchase of software and hardware.

Many university departments were cautious during this time -- which happened to be to their advantage. An example was the business office for Housing Accommodations Management and Dining Service Management for the undergraduate residence halls and graduate houses. They carefully considered the new technology and decided to gradually replace the "dumb" terminals with PCs. At the same time, some "in house" PC systems were developed and/or maintained by their own computerization support staff. While this occurred, the plan for a university-wide fiberoptics backbone was being proposed. (The telephone cables became obsolete that day!) Nevertheless, in the business offices for Housing Accommodations Management and Dining Service Management, it was business as usual. No attempt was made to disrupt a successful business operation because of new technology.

Still, the Dining Service Management business office had recognized the need for a multifunctional computerized system. After careful consideration of their needs and what packages could offer, they proceeded with plans to have ADPC develop and install a fully, automated food service system with planning menus, recipes which included food preparation instructions, food ordering, and food inventory for use by the undergraduate residence halls. This Food Service Management Information System (FSMIS) was installed to service the client areas daily (24 hours a day) in the foods offices of the undergraduate residence halls, at the business office for Dining Service Management, and in the food stores office. In this instance, the technology was used appropriately and successfully to meet a business need.

With this success story to build upon, the natural next step was to direct attention to the Housing Accommodations Management business office. There the processing of new undergraduate applications, housing agreements, and subsequent hall assignments to the twelve undergraduate residence halls at Purdue had been done manually for many years.

In one year's time that office sends out over 20,000 application packets to newly admitted students who have expressed an interest in university housing. There was a growing need to expedite the processing of returned applications and, at the same time, continue to personalize the correspondence for prospective residents. This is just one way of making certain all

those interested in undergraduate housing at Purdue University receive information promptly and correctly. This becomes even more important if the enrollment starts to decline as predicted due to the decreasing number of high school graduates.

Normal enrollment at Purdue University is around 32,000; the undergraduate residence halls house nearly 10,000 of these students, mostly freshmen. Since this is almost a third of the student population, even if enrollment dropped 1,000 that could mean as much as 300 vacancies in the undergraduate residence halls! Some right moves must be made to attract not only new residents but retain the current resident population.

Right moves meant maintaining the competitive edge, but as David Bridgeman, manager of Competitor Analysis at British Petroleum (BP) corporate center in Cleveland states, "Competitive analysis is thinking about external forces over which you have little, if any, influence. In a way, it complements economic analysis. We can attempt to understand how external forces [**declining enrollment and housing costs**] affect us and take steps to optimize our performance given the possibilities. The same holds for competitor actions and reactions. But we need to strike a balance between being too inwardly focused and too externally oriented."* The director for Housing Accommodations Management decided to "take steps to optimize our performance given the possibilities" by asking some important questions.

How best could students be attracted and retained in the residence halls? Already the food service provided was excellent with the recently added attraction of meal plans. Student computer labs were being placed in each undergraduate residence hall and a new hall was being built to replace an outdated hall. Was there a solution in new technology being made available to the university?

Coincidentally, these questions occurred at the same time that the fiberoptics backbone proposal was being approved. Technology would soon be available to provide the needed access to data. The business office of Housing Accommodations Management could "track" information about prospective residents as they were given housing accommodations information and produce correspondence quickly from downloaded student information. This could allow the office to provide

(and record) a personal response to individual requests much more quickly.

The idea for a Purdue Resident Information Data Exchange (PRIDE) system was conceived! Its central purpose was to track the prospective resident from the time the student was admitted to the university until actually completing a housing application, signing an agreement, and being assigned to a hall. The business office of Housing Accommodations Management wanted to analyze how best to meet the needs of the prospective resident population. Building on this information, the needs of the current resident population in the undergraduate residence halls and the graduate houses could also be considered.

The whole process begins when the prospective resident contacts the university admissions office about being admitted. Upon admission, the business office of Housing Accommodations Management is notified. They respond by sending a packet of university housing accommodations information to the prospective resident. PRIDE is first initiated by entering the student id into the system. This indicates that a packet will be mailed to the prospective resident. Counts are kept for future analysis of both male and female students who have been sent a packet. These counts are available both online and in a weekly report.

As applications are returned, they are keyed into the system along with specific attributes about the applicant to indicate the type of correspondence to produce. For instance, if an applicant indicates a physical limitation or dietary concern, these attributes are selected and paragraph codes downloaded (along with the student information) to be used to indicate specific paragraphs to print in a personalized letter to the applicant. Again, counts are kept of attributes and completed applications for both male and female applicants. Forms are generated such as a cash receipt voucher which is sent to the collections office with the deposits received for applications and labels for each housing applicant.

All correspondence and some forms are printed in the business office of Housing Accommodations Management while large batches of agreements and weekly reports are produced at ADPC. A new laser printer was purchased for use by ADPC to replace many of the green

bar reports and many of the cumbersome and expensive multipart forms used by the clients. One such three part form was the housing agreement. The business office of Housing Accommodations Management became enthused about creating a new agreement on the laser. With assistance from ADPC technicians, they have developed five different agreement forms to be produced on the laser. This saves time and money while providing a better service to the customer--the student! (Part of the savings was realized by utilizing a software package for verifying mailing addresses and obtaining zip+4 codes.) In the near future, we hope to also utilize the bar codes provided by this same software package and additional savings from yet another software package for mailing the agreements.

The returned agreements are entered into the system, along with the hall preferences and roommate requests. Mutual roommates are recorded. A priority date is assigned by the system and when the hall assignment batch process is complete, all 6,000 new undergraduate students are assigned to a preferred residence hall based on a priority date, roommate requests, and available space. This has greatly enhanced not only the agreement entry process but also the hall assignment process. Hall assignment statistics show that the majority of applicants do receive their first hall preference. Furthermore, it takes just hours rather than days to provide these assignments to the halls.

This completed the first phase of PRIDE with the exception of the installation of fiber which required that we change from one software package to another to complete the download of information for printing correspondence and forms.

Once the applicant is assigned to a residence hall or graduate house, they are considered a resident and as such, become the responsibility of the residence hall or graduate house.

As we took the next step to develop the remaining pieces of PRIDE for the undergraduate residence halls such as room assignment, cancellation, reapplication, room changes and so on, two residence halls became pilot or test sites. These two pilot residence halls were outfitted with the necessary hardware and software to try processes in PRIDE before being used by all

undergraduate residence halls.

To conduct a successful pilot, the two halls were required to keep their current PC based system updated along with the new PRIDE system. Although the residence halls do not produce the abundant correspondence that the Housing Accommodations Management business office does, they have an abundance of reports and forms such as the reapplication agreement, alpha directory, floorchart, meal plan list, notice of assignment, and vacancy, to name just a few. They also needed the capability of using downloaded resident data to print reports and forms in the residence hall rather than offsite.

As a pilot test of the File Transfer Protocal (FTP) software which was to be used with the fiber to download or upload data, the two pilot undergraduate residence halls were given access to the ADPC file server and by using FTP could obtain resident data for reports and forms. Based on some change just completed such as a room change, or for general information reports, data is requested online. This online process submits a batch job to the internal reader at ADPC to produce an extract reporting file which is then placed on the ADPC file server. The client signs into FTP and requests the information (based on the needed report or form) to be downloaded to the PC at their workstation. Using MicroSoft Word or Dbase, the report or form is produced. Without the fiber, this process is slow; with the fiber, it is a completely different story! Good-bye "sneaker net" and hello fiberoptics!

We were aware that most of the undergraduate residence halls had only one PC available in the foods office and in the main business office to service a staff of 4-6 in each. To use the capabilities of the new PRIDE system and the fiberoptics technology, newer hardware and more of it was needed. The division of Housing and Food Services made a rather large acquisition of 96 new PCs to be installed in the business office of Housing Accommodations Management and Dining Service Management as well as in the undergraduate residence halls and the graduate houses.

Plans were made to follow the fiberoptics installation into the undergraduate residence halls with the new hardware and the new PRIDE system. This meant that after physical facilities staff installed the wiring in the residence hall, the network staff

"lit" the fiber, and ADPC staff connected the fiber to the PCs. It also meant that a standard configuration on all PCs must be installed before being connected to the fiber.

Over half of the office staff had never had a PC at their workstation. This meant that ADPC somehow had to assess the PC training needs. A PC Skills Self-Appraisal was developed, and a copy (with instructions) was sent on diskette to each staff member. In this way, they could assess their own training needs for the PC, and then sign up for classes given by ADPC. The residence hall staff also needed training to understand what standard configuration meant, how to access FTP, and how to use the new PRIDE system!

A plan was devised to give each undergraduate residence hall a week during the summer of 1992 to receive new equipment, have it connected to the fiber, have the current data converted for use by PRIDE, and be trained to understand standard configuration and how to use PRIDE and FTP.

Fiber installation was slowed down by the fact that only one person was allowed to "light it." We fell short of the installation goal by two residence halls. Six residence halls had complete fiber connection, four had the connection via one PC, and two residence halls had the telephone cable access again requiring that two systems be kept in sync. It is gratifying to say that those residence halls with fiber were completely happy and became busy trying new ideas themselves for reports and forms as well as business processes! Those who had to wait longer to download the data or worse still, use "sneaker net" were not so happy. The good news is, they did not have to wait very long! By the second semester of the 1992 academic year, all undergraduate residence halls, the graduate houses, and the business office of Housing Accommodations Management and Dining Service Management had access to the fiber.

With the advent of fiber, every PC regardless of location is given access to the mainframe at ADPC. This provides access to the FSMIS system, the PRIDE system, the collections system, the registrar system, the stores requisition system, and other mainframe systems from any PC! Because of twofold security, only those who have access to the FSMIS or PRIDE system (files and processes) based on their security profile,

can update information for their residents and can inquire about all residents in the undergraduate residence halls - past, present, and future!

Training is always the mountain to climb. Fortunately, new technology has also provided the means to train effectively! The training area at ADPC continues to be utilized for classes about new phases of PRIDE as well as courses in PC skills, FTP and standard configuration. Each residence hall has a "key user" who can support and train other residence hall staff which provides for transfer of knowledge and job satisfaction.

To accompany the training, reference guides were developed, one for the FTP software and one for the new PRIDE system. Each time a large process is completed for use by the residence halls, hands-on training is provided. The PRIDE Reference Guide is also updated as new processes are introduced or as new business areas are added to the system.

Reviews of the major processes are conducted as they are completed; based on the business needs, requests for enhancements are made and prioritized. This rework to the PRIDE system is scheduled to be undertaken when there is a lull in development of the next subsystem or phase.

By the fall of 1993, the graduate houses also hope to be using PRIDE, and the business office of Housing Accommodations Management and Dining Service Management hopes to have their own network and file server. This will further enhance the communication between the undergraduate residence halls, the graduate houses, the food stores office, and the business office of Housing Accommodations Management and Dining Service Management as well as with other university departments outside the realm of housing such as continuing education which is the registrar for conferences at the university.

Event Planning and Administration which handles conferences at Purdue University is also considering an updated computerized system to be used to make housing assignments and bill conference attendees. Many conferences, both large and small, come to the university during the summer, bringing revenue to the university and the community. An August 3, 1992 article by Joe Gerrety in a local newspaper (Lafayette Journal & Courier) addressed that subject and stated:

> The conference (Methodist Men) has a budget of about $1 million, and James Snead, one of its organizers in Nashville, Tenn., said about 7,000 men are expected to attend the next conference in 1993. By the time they leave, they will have spent about $1.5 million, Snead estimates. The conferences (at the university) attract 85,000 people for an average stay of two days, according to Gary Lee, associate director of conferences. Lee said a fiscal impact study conducted nine years ago determined that Purdue conferences pumped $25 million to $30 million a year into the Greater Lafayette economy.

Beyond 1993, computerization plans include (in particular) interfaces to FSMIS and PRIDE, and (in general) whatever else may be needed for these areas to operate effectively in the 21st century in this giant chess game!

As William Hartston, an international chess master stated, "There are some easy ways to lose a chess game: first, do something when you should be doing nothing; and second, do nothing when you should be doing something. Everything depends on how well placed the opponent is to counter what you are trying to do, and to launch a successful aggressive action of his own. Two other easy ways to lose a chess game are to plow ahead with your strategy, regardless of what the opponent is doing, or to have no strategy other than to avoid mistakes."*

What is the best stategy? Most computerization experts believed just a decade ago that the business would be changing because of new technology. Today we see the public university's business changing more because of the customer or competition. For most, it is important to concentrate on the business at hand. For, as Mr. Bridgeman of BP stated, "Business books are filled with examples of how companies thrived or suffered depending on how much attention they spent on the customer and the competition."* In the meantime, a successful computerization effort can be achieved by the use of new technology as it becomes available, to not fear it or change just for it, and to always affect quality not quantity. In essence, allow new technology to drive new technology!

Shield. The International Magazine of the BP Group, U.S. Edition. Cleveland, Ohio. Summer 1992.

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INFORMATION TECHNOLOGY: The Revolution Continues

STUDENT SUPPORT SYSTEMS

W1-1

Graduate School Degree and Satisfactory Progress Tracking System

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38th Annual
College and University
Computer Users Conference

Hosted by Baylor University
in San Antonio

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66

Graduate School Degree and Satisfactory Progress Tracking System

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The University

The University of Wisconsin-Madison was founded as a land grant institution in 1849. As the flagship of the University of Wisconsin System, it has consistently ranked in the top 10 universities in America in every survey of scholarly reputation conducted since 1910. UW-Madison offers 156 bachelors degree programs, 184 masters degree programs, and 125 doctoral and professional degree programs. Graduate study has been offered for over a century, and there are now programs in the biological sciences, physical sciences, social sciences and interdisciplinary studies. In the 1991-92 degree granting year, 680 PhD degrees and 1,981 Master's degrees were reported.

The University maintains extensive research facilities, some of which are administered by the Graduate School. These facilities support the research of students and faculty beyond their principal disciplines and provide broad public service.

UW-Madison has total enrollment of 41,948 students, including 27,464 undergraduates, 10,414 graduates, 1,836 professionals, and 2,234 special students. The FTE enrollment is 37,313.

Efforts to reduce enrollment at the University in the past five years have been successful. Although the number of graduate students has steadily increased, the number of degrees granted has remained constant. For the first time in history, the Graduate School is facing enrollment management.

Administrative Data Processing (ADP), a part of the University's Division of Information Technolgy, is the main provider of computing support for administrative functions for UW-Madison. One of its major roles is to support the Integrated Student Data System. ADP and the Graduate School designed the Graduate Academic Student Progress system to help manage graduate enrollment.

Background

The Graduate Academic Satisfactory Progress (GASP) system replaced the old Grad School Degree reporting system, which was designed to meet quickly the immediate needs of the Graduate School. The system was developed using a software package developed internally. Information for Master's and PhD degrees not entered using that transaction was kept on a card system and within the individual graduate student's paper files. Space constraints and the need to better serve grad students and departments prompted the Graduate School to move to a paperless recordkeeping system.

System Description

The GASP system enables Graduate School staff at the University of Wisconsin-Madison to track degrees and satisfactory progress. GASP integrates information formerly maintained on paper and on the mainframe computer. Graduate School staff can review each student's status online. Eventually, graduate departments/programs will be able to review and enter online data that is now provided on paper to the Graduate School.

The GASP system has six parts: Degrees, Prelims and Other Requirements, Grades, Change/Add Major, Information for Departments and Students, and Degree Committees and Minors.

Degrees

The degree tracking component of the GASP System replaced the system of reporting graduate degrees to the Registrar's Degree Summaries Office and allowed the Graduate School to phase out an old degree card file system. Benefits of the degree tracking component of GASP include:

1) Discontinued the batch job that produced master's degree cards and totally eliminated the master's and PhD card file and the need to manually type and file each card after a degree has been granted;
2) Ended the need to proof warrants against degree cards;
3) Will automate the production of documents and reports formerly generated as word processing documents or by hand:
   - master's, prelim, and final PhD warrants;
   - follow-up letters to students who have not completed degree requirements;
   - letters/reports to departments indicating student degree status;
   - reports to the Registrar regarding cooperative degree students from UW-Whitewater or UW-Oshkosh;
   - reports to the Registrar listing students who have changed or added a major.
4) Will eliminate the need for the Registrar to re-key degree information and therefore allow for a more timely and accurate posting of graduate degrees. An edit system is now being developed to eliminate common keying errors.

Prelims and Other Requirements

GASP provides teleprocessing screens to record PhD preliminary exams, the completion of major and minor requirements, and the completion of the Graduate School residence requirement. The residence requirement is calculated by hand each semester depending on satisfactory completion of current course work. GASP will be used for information that is now input via the Grad Student Info Change transaction. Additional data, now stored on the PhD cards, will also be input via GASP. Thus departments will be able to view information once available only on cards.

Benefits of this component are:

1) Will produce automated dissertator letters thereby eliminating the need to manually affix labels to letter(s);
2) Will make possible timely feedback to students and departments about dissertator eligibility;
3) Will reduce phone calls and foot traffic at the Graduate School;
4) Will provide up-to-date information about residence for students and departments;
5) Will assure students that they are not short of residence at the dissertator stage or for master's degrees;
6) Will produce a report for departments listing PhD candidates who were within one year of the "defend within five years of passing prelims" requirement. This department report also lists the student's thesis advisor and reminds the department and student of the five-year rule.

Grades

GASP automates the identification and monitoring of students with GPA problems and Incomplete/Progress/Not Reported grades. This information was formerly calculated manually and recorded on paper in student files after staff reviewed semesterly reports. The system now interacts with the Registrar's student data files to calculate the Grad School GPA and to monitor Incomplete/Progress/ Not Reported grades. A planned enhancement will generate a list of cleared Incomplete grades and the effect on the student's GPA and degree status.

The benefits of this component include:

1) Will greatly reduce the time needed for Graduate School staff to review a student's records;
2) Will inform students and departments more quickly of Graduate School warnings, probations, or drop actions;
3) Will generate a weekly report of degrees that were held because of grades and will indicate when the grade has been cleared;
4) Will generate for departments a list of courses taken outside the department with Incompletes.

Change/Add Majors

GASP automates the change/add major process. This process involves an application and an admission decision. This information was stored in the student paper files, and only a positive decision to either change or add a major was reported to the Registrar via a paper form. Graduate School staff now enter the decision into GASP and may request an automated list.

The primary benefit of this component is that it allows the Graduate School to know the number of change/add requests and track them in the admission process. Ultimately, it will provide additional information for the "time to degree."

Information for Departments and Students

After a future enhancement, an inquiry transaction will enable departments/programs to gain access to certain fields on GASP. Some of this information may eventually be available to students via a current transaction called Extended Access to Student information (EASI).

Benefits of this component include:

1) Will reduce the number of phone calls and foot traffic to the degree offices, especially at peak periods in the degree-granting process;
2) Will provide immediate feedback about such items as: cumulative weeks of residence earned to date, whether a student has been certified for dissertator status, and whether the warrant was issued.

Degree Committees and Minors

Allowing departments to update certain fields on GASP will help them monitor the degree committees and the minor agreement approval process. This enhancement will eventually help track departmental criteria for satisfactory progress.

Benefits of this component include:

1) Will eliminate forms now submitted by departments to record the minor approval ar.. the final oral committees; GASP will check faculty eligibility and monitor tne PhD minor requirements;
2) Will produce departmental reports listing faculty advisor/dissertation chair, time to achieve dissertator status, and time to degree tied to student employment history;
3) Will help departments track faculty responsibilities for graduate students.

System Design

GASP was implemented on an IBM mainframe computer. The system takes advantage of the strengths of COBOL II and DABAL IV (a report writing language developed in house) for the programming languages. The teleprocessing monitor is IMS. The information repository is DB2, an IBM relational database system.

Database Design

An important reference in defining the database's entities was *Entity Modeling: Techniques and Application* by Ronald G. Ross. The eight entities defined by the process are:

Student

Student, for GASP purposes, is the collection of existing Registrar student files. These IMS files are the repository for core student data of interest to the entire campus. Included in Student are student name, date of birth, address information, classification, year in school, course registrations, and other transcript information.

Degree Tracked

Degree Tracked is the kernel entity for the degree tracking system. The primary key is degree number (a system-assigned number.) Student ID is carried as a foreign key to provide access to the student's other campus records. A grad student will have one record for each degree attempted. The record contains information

specific to the degree being tracked. This includes degree code, degree expected, conferred, and reported terms, exam dates, thesis deposit date, etc.

Degree Major

A degree may be granted for either a specific major or a joint major. Additionally, at the PhD level, the degree may be for a specific option within the major(s). This table holds the major code, option, and major completed date. It is keyed by degree number concatenated with a sequence number, allowing for storage of the joint majors (current business rules allow up to four majors).

Degree Minor

PhD degrees may have an associated minor and option. The minor table is keyed by degree number concatenated with a sequence number. The business rules call for storage of up to four minors. This table stores the minor code, option, minor expected, and actual completion terms, departmental sign-off indicator, and departmental approval date.

Degree Committee

PhD committees must have a minimum of five graduate faculty and a maximum of six. Master of Fine Arts committees must have a minimum of four and a maximum of five, and master's committees a minimum of three and a maximum of five. Graduate faculty includes all tenure-track faculty holding professorial (full, associate, or assistant) rank in any department with graduate program authority, including those faculty with zero-time appointments, and who are eligible to serve as a major professor and serve on doctoral and master's examination committees.

The key for this table is degree number concatenated with a sequence number. This table currently contains the committee member's name and the department he or she represents. A future enhancement will provide an interface to the University's appointment system. This will eliminate the need for the Graduate School to enter and store committee member name; instead, only the primary key of the appointment system will be maintained.

Problem Course

Grades of NR (not reported), PI (permanent incomplete), I (incomplete), and P (progress) in courses above the "300 level" are not acceptable for meeting the requirements of graduate-level degrees. Also, at the PhD level, grades of F (failure) and U (unsatisfactory) are not acceptable. The list of courses with unacceptable grades is compiled from the student's transcript files for display on GASP. The Problem course table is used at the master's level to indicate either: 1) Grad School has approved the course grade, or 2) the student is also pursuing a PhD degree and this course work is to be applied toward the PhD degree, not the master's degree. The Problem course table is keyed by student ID concatenated with a sequence number. Up to six course numbers, terms of enrollment, and PhD/Grad school approval indicators are allowed.

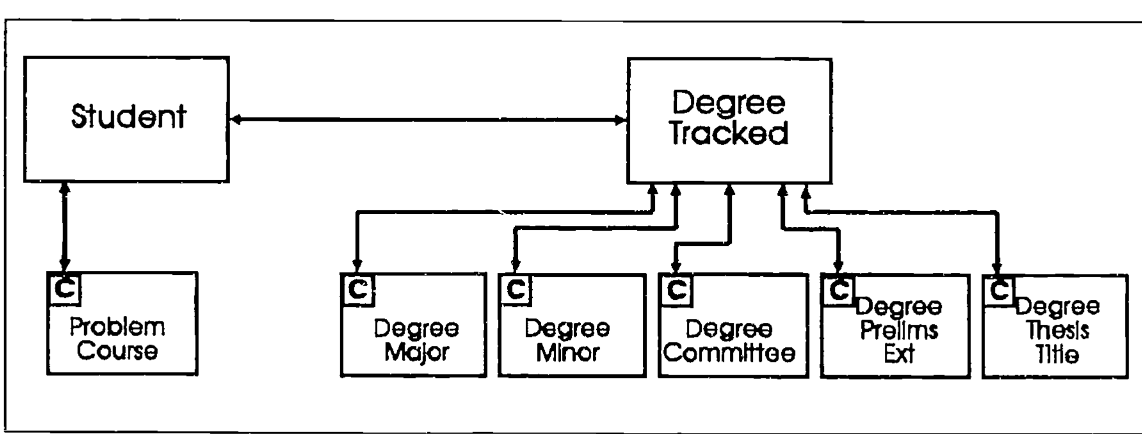
Degree Prelims Ext

A candidate for the PhD who fails to take the final oral examination within five years after passing the preliminary examination is required to take another prelimi-

nary examination and be admitted to candidacy for a second time. This table records exceptions to this rule. Up to three prelim extension dates may be granted.

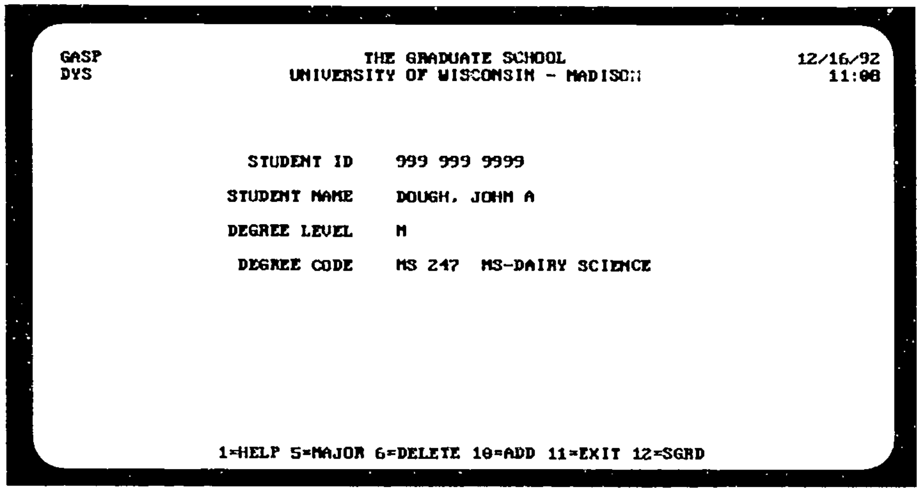
Degree Thesis Title

This table holds the free-form title of the PhD thesis. Up to eight lines of 78 characters each can be displayed. The thesis must be the candidate's own work. It may be the result of research enterprises in which others have collaborated; but in such cases, the candidate is required to present a substantial portion which represents the candidate's own contribution.

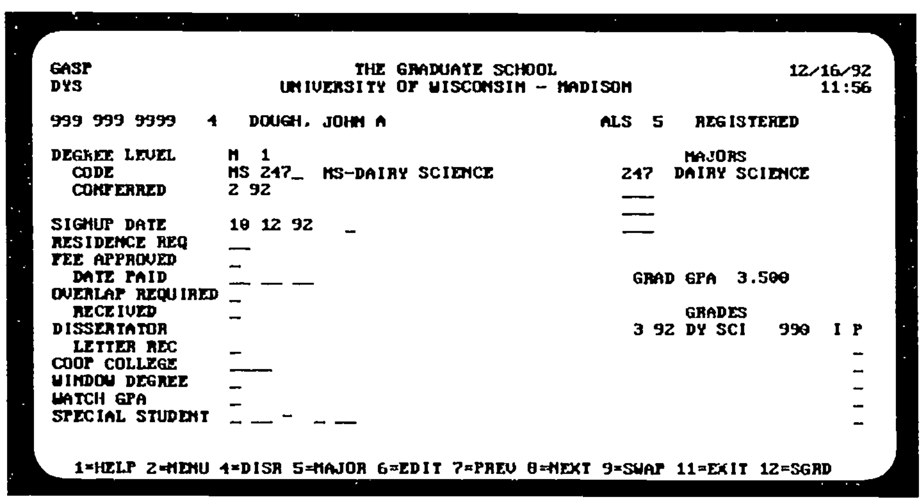


Entity Relationship Diagram for the GASP System

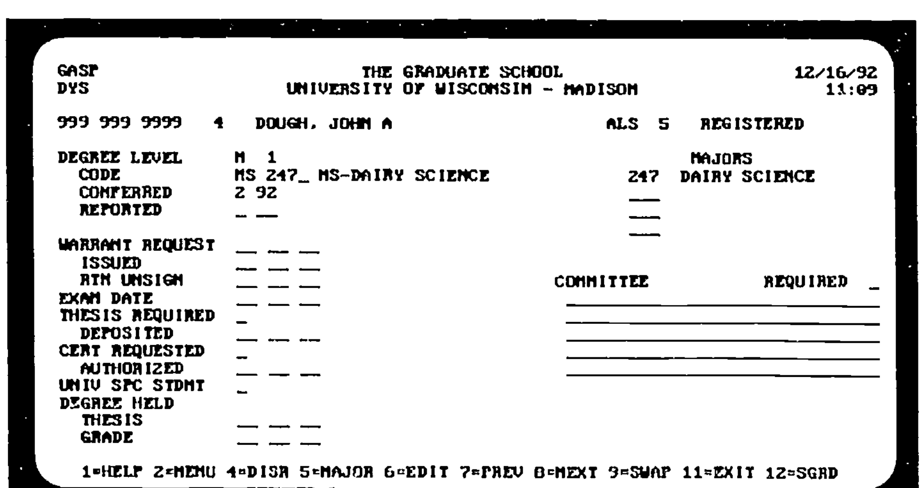
GASP System Screen Samples



Menu and Error Screen



Master Sign-up and Clearing Screen



Master Warrant Screen

```
GASP                              THE GRADUATE SCHOOL                          12/16/92
DYS                        UNIVERSITY OF WISCONSIN - MADISON                      11:09
999 999 9999   4   DOUGH, JOHN A                          ALS  5   REGISTERED
DEGREE LEVEL      P 1  CODE  PHD     DR. OF PHILOSOPHY

RESIDENCE REQ     2  110       MAJORS
  COMPLETE        1 92             247 DAIRY SCIENCE
PRELIMS DATE      12 01 92         ___
  EXTENSION 1     __ __ __         ___
  EXTENSION 2     __ __ __         ___
  EXTENSION 3     __ __ __     MINORS
DISSERTATOR       1 90             001 NO MINOR REQUIRED
WARRANT ISSUED    __ __ __         ___
FEE OWED          ________         ___

COURSES                        COMMITTEE            JOINT CHAIR  _
   3 92 DY SCI    990  I           MEMBER, ONE_______________________ 247 DAIRY SC
   1 93 DY SCI    990              __________________________________ ___
                                   __________________________________ ___
                                   __________________________________ ___
                                   __________________________________ ___
                                   __________________________________ ___

      1=HELP 2=MENU 4=MASTR 6=EDIT 7=PREV 8=NEXT 9=SWAP 11=EXIT 12=SGRD
```

PhD/DMA Committee Screen

```
GASP                              THE GRADUATE SCHOOL                          12/16/92
DYS                        UNIVERSITY OF WISCONSIN - MADISON                      11:37
999 999 9999   4   DOUGH, JOHN A                          ALS  5   REGISTERED
DEGREE LEVEL   P 1    CODE  PHD     DR. OF PHILOSOPHY

EXAM DATE       __ __ __     COURSES                  PRELIMS DATE   12 01 92
THESIS APPROV   __ __ __       3 92 DY SCI   990  I     EXTENSION 1  __ __ __
  DEPOSITED     __ __ __       1 93 DY SCI   990        EXTENSION 2  __ __ __
DEGREE CONFER   __ __                                   EXTENSION 3  __ __ __
  REPORT        __ __                                 DISSERTATOR    1 90
CERT REQ AUTH   __ __ __                              FEE OWED       ________
GRAD GPA        3.500

THESIS TITLE
    __________________________________________________________________________
    __________________________________________________________________________
    __________________________________________________________________________
    __________________________________________________________________________
    __________________________________________________________________________
    __________________________________________________________________________
    __________________________________________________________________________

      1=HELP 2=MENU 4=MASTR 6=UPDTE 7=PREV 8=NEXT 9=SWAP 11=EXIT 12=SGRD
```

PhD/DMA Thesis Screen

```
GASP                              THE GRADUATE SCHOOL                          12/16/92
DYS                        UNIVERSITY OF WISCONSIN - MADISON                      11:10

999 999 9999   4   DOUGH, JOHN A                          ALS  5   REGISTERED

DEGREE  M 1  MS 247   MS-DAIRY SCIENCE


                    ACTION   MAJOR
                      _      247   DAIRY SCIENCE
                      _      ___
                      _      ___
                      _      ___




                  1=HELP 2=RETURN 6=EDIT 9=LIST 11=EXIT
```

Major Changes Screen

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INFORMATION TECHNOLOGY:
The Revolution Continues

STUDENT INFORMATION SYSTEMS

M2-2

The Registrar Does Structured Query Language: The Era of the Ad Hoc Query Has Arrived Just in Time to Help the Registrar

Ann M. Liska
Lawrence Technological University

38th Annual
College and University
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Hosted by Baylor University
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May 9–12, 1993

THE REGISTRAR DOES STRUCTURED QUERY LANGUAGE
SUBTITLE: THE ERA OF THE AD HOC QUERY HAS ARRIVED JUST IN TIME TO HELP THE REGISTRAR

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About five years ago, Lawrence Technological University began work on a computerized student records system. For many years, Lawrence Tech had used a hard copy record keeping system; permanent record cards were maintained for each student, and grade labels were pasted on the cards for each term the student attended. Computer storage was so limited and expensive that only summary totals were kept in computer files. The Registrar's Office was required to keep the summaries, which were hard-coded in the files, up to date by filling out coding sheets each time a grade change, grade point average recalculation, or other change was made to a student's record. This system was replaced in 1988 by the Academic Information System (AIS). More than 45,000 student transcripts are now stored on-line in the AIS data base.

During the intervening time, the Lawrence Tech disk storage capacity on the VAXCLUSTER has been increased to 26 gigabytes.

A great deal of planning went into the design and implementation of the AIS. A consultant from Digital Equipment Corporation spent a year on campus working on the design and documentation. The deans and directors were interviewed to determine system requirements. Weekly meetings of the design team were held. The Registrar, Ann Liska, and the Computer Center director, John Grden, worked closely on the project and were confident that the new system would meet the institution's requirements. In June of 1988 the University printed the last set of permanent record cards, and the AIS was put into production in August of 1988.

The database system used for the AIS is Digital Equipment Corporation's VAX Rdb, a relational database. In a relational

database, the data appear as a collection of tables. These tables can be manipulated to produce desired reports, either through the standard AIS interface, through the Relational Database Operator (RDO) utility supplied by Digital, or by using Structured Query Language (SQL). RDO, although it can be used interactively, is mainly designed to be used in programs. SQL is easier to learn and can be readily used either interactively or in programs.

A list of the tables that currently comprise the student database, STUDENT_INFO, can be found in Appendix A.

Each table contains various data elements. Here is the information found in the DEGREES table:

DEGREE_NUMBER	a unique number assigned to each degree program
DEGREE_CODE	a two letter code representing the degree program
DEGREE_TYPE	level of degree
DEGREE_NAME	name of degree to appear on transcripts
DEGREE_CURRENT	is degree current - Y/N
DATE_ADDED	system date degree was added
ADDED_BY	user code of DB Administrator who added degree
GRAD_DEGREE	is it a graduate degree Y/N
ADM_DEGREE_CURRENT	can persons currently be admitted to this degree program - Y/N

Table 1: Degree_granted

From the perspective of five years into production, it appears that

we were remarkably accurate in predicting the standard reports that would be needed. This is not to say that no problems have occurred. The process of "getting off cards" proved painful in some ways and some users still print large volumes of hard copy reports. With the aid of the Veraldi Center for Educational Technology at LTU (our user-services department) we plan to imbue those paper-oriented users with the advantages of paper-free operations. We also designed some reports that were thought to be desirable, but are now rarely used.

Our most pressing problem became the need for ad hoc reports. Since it was impossible to plan for every report that might be needed, our initial plan was to have users fill out a form requesting the special reports. In fact, a form was designed and can still be found in the users' guides, but it has never been used. Typically, the need for special reports coincides with a vital project such as an accreditation visit, and there is insufficient lead time to allow users to fill out a form and wait for a response. Our programming and user support team is small for a university of our size. Like most other universities in these competitive times, we are trying to provide more services with the same size staff. It was essential that a way be found to deal with the situation.

The Registrar was concerned about this problem and discussed it with the President, Computer Center director John Grden, and the Director of the Veraldi Center (LVCET). The LVCET director, Professor Thomas Lackey, suggested that SQL could be used to obtain the needed reports.

Another solution would have been to purchase one of the many fourth generation language (4GL) products, which allow users to form their queries in English-like syntax. The 4GL interface then finds the data and returns the results. We have found, though, that by having a few individuals use SQL, the majority of user requests can be satisfied. More complex reports can be done by the programmers as time permits. In our case, also, some of the data resides in files that are not part of the student information database. 4GL products could not easily find this data. Another important consideration was that we already had a site license for VAX SQL, so no additional expense, beyond training time, would be required.

Occasionally, one finds that in using SQL, some queries can take a long time. Many factors can be involved in this delay, including overall system work load, other users working with the database, and SQL's method of forming queries. For example, suppose we needed a list of students who attended during a particular term, whose cumulative grade point average is 3.5 or above, and who are engineering majors. SQL would first find everyone who attended, then go through the entire group again to find the gpa, and then a third time to find the major. A more efficient way to accomplish this might calculate the gpa instead of looking it up, but this

still requires a second pass to look up the major. A program can be written to find the students and their major and then "save" this data so that the second pass looks up only the affected students. Whether this is worth doing or not may depend on how frequently the report is needed. If it's to be run once a year, it may be just as efficient to run the report interactively the one time it's needed, and save the programming time for higher priority tasks. Alternatively, the report can be done overnight in batch mode; the VAXCLUSTER runs through the night but, as would be expected, interactive use falls off dramatically at night.

Here are some examples of reports the Registrar has been able to do with occasional assistance from the Veraldi Center and EDCC staff.

(1) The College of Architecture and Design wanted to analyze the performance of their transfer students. The Registrar entered the following query in SQL:

```
SQL> select student_number, last_name, college_code
cont> from student_profile where date_entered_lit = '199109' -
cont>    and major='AR' and college_code > 0 -
cont> order by college_code;
```

(Note: The "cont>" simply indicates a continuation from the previous line).

This produced a list of Architecture majors who entered the University in the Fall of 1991 and who had transferred from another institution. Similar reports were done for the other terms of the 1991-92 academic year. The resulting lists were then combined and could be sorted by the College by either student number, last name, or college code. Many other fields are available in the data base which could also have been used, depending on user requirements.

STUDENT_NUMBER	LAST_NAME	COLLEGE_CODE
074948	WOLF	904
075009	PUROL	1011
075016	LENTZ	1035
074984	STRAUSS	1051
074959	STALLONE	1083
074949	ROBERTS	1095
074971	MALTBY	1106
075013	DEYOUNG	1201
074240	CHIODINI	1201
074580	JACKSON	1201
.		
.		
.		

Figure 1: entering transfer students and college code

(2) The Registrar's Office needed to make sure that the degrees for June 1992 graduates were conferred correctly. Each degree is posted individually, and there is always the possibility of a data entry error. The SQL query to check degrees posted in June, 1992, looks like this:

```
SQL> select a.student_number, a.degree, b.last_name,
cont> b.first_name from degree_granted a, student_profile
cont> b where a.degree_date = '199206';
```

The resulting list was then sorted in alphabetical order by major, making it easy to check against the hard copy Commencement program.

(3) The Dean of Arts and Science and the Dean of Students wanted to find students who entered the University during a certain term, and who were "first time in any college", that is, not transfer students.

```
SQL> select distinct student_number, last_name, first_name from
cont>student_profile where date_entered_lit = "199203" and
     college_code = 0;
```

```
STUDENT_NUMBER   LAST_NAME        FIRST_NAME
075531           SHANNON          SCOTT
075532           LLEWELLYN        DARRIN
075535           ROCKWELL         CINDY
075537           DAWSON           REBECCA
075538           STANDEN          JOANNE
075539           FILARY           ROBERT
075540           LEWIS            STEVEN
075541           CHAMBERS         AIMEE
075543           HOLMQUIST        DANNY
075544           BOZYK            DAVID
.
.
.
```

Figure 2: entering FTIAC students, March 1992

The AIS stores a numeric code which can be translated into the institution the student transferred from. If the college code is zero, that student is probably "first time in any college". Another way to approach this problem would be to search by high school graduation date.

(4) The Registrar's Office needed a list of student numbers to mail Fall registration materials to eligible students. This is slightly more complicated, in that students who are academically ineligible to re-enroll cannot receive this mailing.

```
SQL> select distinct student_number from student_profile where
cont> last_term_attended > "199207") and
cont> student_number not in (select student_number from
      dismissal where date_of_dismissal > '01-Aug-1992');
```

The above finds students who attended during academic year 1992-93 and were not dismissed from the University. The resulting electronic list of student numbers is used as input to a program that produces mailing labels.

```
STUDENT_NUMBER
006115
013774
016948
017357
017762
018178
018527
019824
019963
.
.
.
```

Figure 3: student numbers for mailing labels

Although not a programmer, the Registrar has learned to write some programs that make use of SQL statements imbedded in a Fortran program (other languages can also be used). An example of such a program can be found in Appendix B. As mentioned above, one advantage of using embedded, as opposed to interactive, SQL is that data may be "saved" in a temporary table to avoid repetitive queries.

In addition to the Registrar, the LVCET director and the Director of Institutional Research and Academic Planning are using interactive SQL to help meet the reporting needs of our offices and user departments. The EDCC staff is always helpful with technical advice and assistance. Some registrars might say, "that's the computer center's job", but at Lawrence Tech, we recognize that the registrar must act as an advocate and proponent of the student records system.

The ability to meet requests for special information or mailing lists has developed a closer relationship and understanding between the Registrar's Office and other campus departments. Apparently simple requests ("give me a list of all my majors") must often be analyzed before they can be filled: "currently enrolled students only, or all majors? what about dual majors? current this academic year or current this term?" and similar questions must be answered so that the resulting report meets the user's expectations. This interaction has lead to an appreciation of each other's needs. SQL has given the registrar one way to respond to these needs.

Appendix A: tables comprising the STUDENT_INFO database

TABLE NAME	DESCRIPTION
DEGREES	names of all degrees offered in last 20 years
DEGREE_GRANTED	individual degrees
DISMISSAL	individual dismissals
GPA	calculates the grade point average
GRADE_CHANGE	individual students' grade changes
GRAD_GPA	graduate GPA
IDENTIFY_LOG	counts of fields accessed through Identify Students screen
MESSAGES	list of current registration holds
NEXT_STUDENT_NUMBER	calculates the next new student number
OPTIONS	list of majors/concentrations
OPTIONS_LOG	counts of main menu options selected
OUTSIDE_CREDIT	individual students' transfer credit
STUDENT_MESSAGES	individual registration holds
STUDENT_PROFILE	4 screens of information on each student
TOTALS	summary totals used for report cards
TRANSCRIPT	student term data
TRANSCRIPT_MESSAGES	degrees, certifications and dismissals
USER_PROFILE	access types and privileges for each user

Appendix B - Example of Fortran program using embedded SQL

```
C     This program will select RECORDS FROM A DATABASE AND
C         MATCH IT AGAINST AN EXISTING FILE
C
C
C     BASIC PROCEDURE:
C
C     1.  OPEN DATABASE
C     2.  BUILD A CURSOR
C          a cursor is a temporary table where records can be
C           accessed one
C          at a time.
C     3.  DO WHILE DATA
C          FETCH or read A RECORD FROM THE CURSOR
C          IF THIS IS THE RECORD WANTED
C              PRINT RECORD
C          ENDIF
C         ENDDO
C
C
C        THIS PROGRAM MAKES USE OF IMBEDDED SQL.
C        SQL STATEMENTS ARE NOT TERMINATED WITH A ";"  BUT WITH A
C        CARRIAGE RETURN, AS IN FORTRAN.  EACH SQL STATEMENT IS
C        PREFACED WITH "EXEC SQL".
C        (NOTE: Not all interactive commands are valid in
C          precompiled
C        programs. Consult SQL manual.)
C
      IMPLICIT INTEGER (A-Z)

C        SQLCOD (OR SQLCODE IN OTHER LANGUAGES) IS AN INTEGER
C        VARIABLE
C        THAT CONTAINS THE STATUS OF EVERY SQL STATEMENT.
C        IF SQLCOD = 0 THEN SUCCESSFUL.
C        IF SQLCOD = 100 THEN ATTEMPT TO GET RECORD BEYOND RECORD
C        STREAM.
C        IF SQLCOD < 0 THEN FATAL ERROR.
C        (see sql reference manual appendix D for complete list of
C          values
C        for SQLCOD).
C
      INTEGER*4 SQLCOD
C
C        SET UP VARIABLES AND DATA TYPES TO RECEIVE DATA FROM THE
C        DATABASE.
C
      CHARACTER ID*6,FNAME*11,LNAME*20,INPUT_ID*6
C
C
C        DECLARE DATABASE
C
C
      EXEC SQL attach 'filename admindisk:student_info'
```

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```
      EXEC SQL set transaction read only
C
C        DEFINE A TEMPORARY TABLE CALLED A CURSOR. THIS
C        CURSOR IS CALLED "TEMP".
C
         EXEC SQL DECLARE TEMP CURSOR FOR
     -                  SELECT STUDENT_NUMBER, LAST_NAME,
     -     FIRST_NAME
     -                 FROM STUDENT_PROFILE
     -                   WHERE LAST_TERM_ATTENDED = '199212'
     -    AND MAJOR = 'BA'

C        OPEN TABLE FOR USE
C
      EXEC SQL OPEN TEMP
C
C        GET ONE RECORD FROM THE CURSOR.
C
      EXEC SQL FETCH TEMP INTO
      -    :ID, :LNAME, :FNAME
      IF(SQLCOD.NE.0)THEN
          ID = '999999'
      ENDIF
      LS=LS+1

      READ(10,15,END=5) INPUT_ID
 15   FORMAT(A6)
      LI=LI+1
      GOTO 10
 5        INPUT_ID='999999'
 10   CONTINUE
C
C
C
      DOWHILE (ID.LT.'999999' .OR. INPUT_ID.LT.'999999')
C
C
          IF (ID .EQ. INPUT_ID) THEN

           EXEC SQL FETCH TEMP INTO
     -             :ID, :FNAME, :LNAME
           IF(SQLCOD.NE.0)THEN
               ID='999999'
           ENDIF
           LS=LS+1

          ELSE
                 GO TO 110
             ENDIF
 110            WRITE (11,111) ID,FNAME,LNAME
 111            FORMAT( A6, A11, A20)
 120            CONTINUE

        ENDDO
```

```
C
C
C         CLOSE CURSOR
C
      EXEC SQL CLOSE TEMP
C
C         CLEAN UP EVERYTHING
C
      EXEC SQL DISCONNECT DEFAULT
      END
```

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INFORMATION TECHNOLOGY:
The Revolution Continues

STUDENT INFORMATION SYSTEMS

M3-2

Interactive Voice Response Technology—So Many Opportunities, So Little Time...

Genene C. Walker
Arizona State University

38th Annual
College and University
Computer Users Conference

Hosted by Baylor University
in San Antonio

May 9–12, 1993

Interactive Voice Response Technology - So Many Opportunities, So Little Time...

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INTRODUCTION

Arizona State University is among the many institutions in higher education using Voice Response Technology. Student enrollment is over 43,000. ASU is a multi-campus university located in a large metropolitan area. Most students commute rather than live on campus. Less than 10 percent of the student population live in the residence halls. Since the mid-80's, colleges, universities and community colleges have continued to implement this very beneficial and popular technology to provide convenient and efficient service to our customers - the students.

BACKGROUND

The decision to provide an alternative registration method to on-line and (batch) pre-registration was made in August 1989. Because tuition fee payment is an integral part of the registration process, it was quickly determined a touch-tone telephone fee payment system was also needed.

In November 1990 InTouch, ASU's Interactive Voice Response (IVR) System, was implemented. A small pilot was successfully conducted using a Syntellect, Inc. 96 line IVR system. Enhancements were made to the system, and in April 1991 a second pilot, with a larger group of students, was conducted. Planned capabilities and twenty-four telephone lines were added to the system in November 1991. InTouch was then available to all students for spring 1992 registration and fee payment. In July 1992, a Credit Card Authorization feature was implemented. A Class Status feature was available November 1992.

ASU plans to implement a Grade Inquiry system in May 1993. This will give students the opportunity to call from any touch-tone phone to find out their grades, Grade Point

Average, Probation status and so on. Other anticipated applications are: Financial Assistance Inquiry, a Parking System and an Admissions Verification System. Figure 1 reflects the implementation phases and features of InTouch.

• August 1989	Project initiated
• November 1990	InTouch Phase I pilot
• April 1991	Phase II pilot
• November 1991	Phase III - all students
• July 1992	Credit Card Authorization
• November 1992	Class Status
• May 1993	Grade Inquiry
•	Financial Aid Inquiry
•	Parking
•	Admissions Verification

Figure 1. Implementation Phases and Features of InTouch

SYSTEM CONFIGURATION OVERVIEW (Appendix A)

Syntellect's IVR units can connect to a telephone company Central Office (CO), a Private Branch Exchange (PBX) or Automatic Call Distributor (ACD) telephone system. The telephone lines must be compatible with touch-tone service and support a standard touch-tone phone. To avoid over-loading the University's PBX during peak call periods, the 120 telephone lines connect directly from the local telephone company CO.

We have two Emperor cabinets housing 60 lines each (five, 12 line Premier modules). Terminal connection is through an IBM 3745 controller. The host computer is an IBM 3090. In addition, we have multiple data logging and monitoring sites and a four line Premier IVR application development unit.

INTOUCH FEATURES

A brief summary of InTouch features follows:

INTOUCH REGISTRATION SYSTEM (Figure 2)

Within the Registration System, students may purchase health insurance or a yearbook. Once registered, students may add or drop classes as well as withdraw from classes. However, complete withdrawal from the University must be done in-person.

Students can hear a list of their classes in two ways: (1) A "Quick List" provides the class Schedule Line Number, Course Prefix and Number such as: SLN 12345, ENG 301. (2) A "Complete List" includes the class meeting time and the building and room locations.

A Class Status option informs students whether a class is available, full or canceled. Feedback from students in the first two pilots indicated this feature would be very helpful. It is especially useful when attempting to drop one class and add another. In most cases, if students knew the class they wished to add was not available, they would never drop the original class. This feature also reduces the number of accesses to the registration system attempting to find available classes. Also, within the Touch-tone Registration System, students may select the Touch-tone Fee Payment System, hear the above mentioned options again or end their phone session.

1	Registration • purchase health insurance • purchase yearbook
2	Drop/Add
3	Class withdrawal
4	Quick list of classes
5	List classes (time/location)
6	Class status
8	Fee Payment System
9	Repeat options
0	End this phone session

Figure 2. Registration System Features

INTOUCH FEE PAYMENT SYSTEM (Figure 3)

If callers select the InTouch Fee Payment System menu, students may choose the Credit Card option to pay their fees with Visa, Master Card or a debit card. Students receiving financial assistance may also apply their aid award to pay their registration fees after the first disbursement period which is usually the first day of classes. Before the first disbursement date, an Accounts Receivable method of payment is generated, then Financial Aid is used at the proper time.

Students who prepay, overpay, drop or withdraw from classes are automatically mailed refunds at the end of the refund period. If a student anticipates no further

registration activity, a refund can be requested and received by mail within two weeks. Students may change their health insurance coverage by adding or dropping coverage. Students can hear an itemized list of charges including class fees, deposits and miscellaneous fees such as lab fees.

By providing payment instructions, the number of phone and in-person inquires have been greatly reduced. Three of the most common questions asked by students are:

- What is the Fee Payment Office mailing address?
- By when do I have to send my fees in to not lose my classes?
- Where do I go on campus to pay in-person?

Also from this menu, students may choose to return to the InTouch Registration System, hear the above mentioned options again, or end their phone session.

1	Pay with credit card • credit card • debit card
2	Pay with financial aid
3	Request refund
4	Add/Cancel health insurance
5	Itemized list of charges
6	Payment instructions • office address • postmark deadline • payment locations
8	Registration System
9	Repeat options
0	End this phone session

Figure 3. Fee Payment System Features

INTOUCH CREDIT CARD PAYMENT

Few colleges and universities with telephone registration systems have implemented real-time credit card payment. Working with Syntellect and Valley National Bank (VNB), ASU now provides this service to our students.

The credit card authorization application connects ASU with Valley National Bank's authorization system. This

connection is via a standard leased telephone line with a modem dial backup system. The backup system is only used in the event the dedicated leased line fails. ASU has not had a need for the backup system thus far.

Each credit card payment takes less than one minute. A "Point of Sale" transaction is electronically created and sent from ASU to VNB. VNB's system electronically provides InTouch with the transaction response. The response indicates approval or disapproval. Disapprovals can be because of a referral condition or an error condition. Referrals represent requests on the part of VNB for more information from the card holder such as an address or contact phone number. These payment requests are posted then the Student Fee Payment Office follows-up manually with each caller. If disapproved because of insufficient balance, an expired card, and so on, InTouch allows the student to use another credit card and resubmit the payment request. If approved, the student's credit card is charged and ASU's computer system is updated with the student's payment.

Figure 4 summarizes credit card statistics collected from July 13th to August 23rd. This was the six week period before the start of the fall semester, immediately after implementation of the system.

Credit Card statistics reported over 96 percent of the payment requests were immediately approved. The option to pay by credit card was selected over 6,000 times. Of these, 5,673 completed the process resulting in 5,493 payments immediately approved by VNB and 180 declined. After following up with the students, ASU's Student Fee Payment Office manually cleared 102 of the 180 declines using "Point of Sale" units in their office.

Transactions	Activity
6,043	Pay with credit card
5,673	Completed credit card process
5,493	(96.8%) CC payments approved
180	CC payments declined
102	(56.7%) approved manually

Figure 4. Credit Card Statistics 7/13/92 - 8/23/92

SAVINGS

The most significant savings realized using this technology at ASU and other institutions of higher education

are reallocation and/or reduction of full-time and part-time staff in Fee Payment and Registrar areas. Also, reductions of:

- overtime
- forms and paper
- processing and handling time
- phone and in-person inquires

BENEFITS

The greatest benefits are:

- privacy
- security
- reduced workloads
- immediate feedback on credit cards
- immediate feedback on aid payments
- more hours of availability
- fewer students waiting in lines
- convenient and efficient access
- convenience to students

InTouch requires entry of a nine digit ASU-ID number and a four digit Personal Identification Number (PIN) before callers can use the system. The PIN is initially set to the students birthdate (month/day). The caller must change this number to a PIN of their choice when first accessing the system.

InTouch is available Monday through Friday, 7:00am to 9:00pm, Saturday 7:00am to noon, and Sunday noon to 6:00pm. Because of high volume nightly production processing, the system is not available 24 hours a day.

Before InTouch, there were occasions when students would "camp out" all night at the registration sites to be at the front of registration lines. This no longer happens. Also,

the number of students overcome with heat stroke waiting in 115 degree heat in sunny Arizona has been greatly reduced!

All students may use InTouch during hours of availability. Because on-line registration and pre-registration are available, ASU has not had to schedule student access by academic level, or some other method.

INTOUCH VS. IN-PERSON REGISTRATION

The most often heard response from students is how easy and convenient this technology is to use. One of the Registrar Office's favorite anecdotes about the InTouch/In-person registration experience happened during the spring 1992 semester. A student was waiting at an in-person, on-line registration site when the site opened Monday morning. The student wanted to add needed classes to her schedule. As the site worker was processing her registration Course Request Form, the student started into a lengthy explanation. She had gotten up very early, hired a sitter to watch her children and bought gas for her car to drive to campus from the far west side of town. She was pleading with the site worker to find classes for her. The site worker asked if she was aware of InTouch, which is available to all students. She could have called on Sunday with a better chance of getting her classes. The student replied: "Yes, I know about InTouch, but, I would have had to pay for the long distance call." The staff workers were speechless. After the student left, the site workers checked to see if the student was registered for any math classes! As of October 1992 U.S. West eliminated toll charges within the Phoenix metropolitan area. Therefore, this will no longer be of concern to most students!

CONCLUSION

Obviously, not all students are taking advantage of InTouch by using any touch-tone phone to take care of their registration and fee payment needs. However, most students are.

Using interactive voice response technology at ASU continues to be tremendously successful. Using InTouch to register, drop and add classes doubled in fall 1992 compared to the previous semester. Students are taking advantage of this service vs. the traditional, less convenient, in-person services.

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INFORMATION TECHNOLOGY: The Revolution Continues

STUDENT INFORMATION SYSTEMS

M4-2

Steps to a Revolution: A Case Study of Electronic Transcripts at ASU

Katherine Ranes
Arizona State University

38th Annual
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Steps to a Revolution
A Case Study of Electronic Transcripts at ASU

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INTRODUCTION

The transcript is the physical document which provides evidence of a student's academic achievement. In the past, great care has been given to the creation of the physical document. The quality of the paper, the beauty of the script, the elaborate seal all conveyed the importance of the document. The document itself was a treasure. Today, the value of the transcript is not enhanced by its physical nature, but by how quickly the information included in the document can be shared with those who want to use it. In many cases, the physical document is a hindrance. It takes time to create; it's expensive to transport; it's open to forgery; it takes space to store; and it's not easy to retrieve. This paper discusses the steps that ASU has taken to advance the revolution from paper transcripts to those in electronic form.

OVERVIEW OF ARIZONA STATE UNIVERSITY

University Background

Arizona State University is part of a three university system governed by the Arizona Board of Regents. The other members of the system are the University of Arizona in Tucson and Northern Arizona University in Flagstaff. Founded in 1885, ASU has 12 colleges and schools. The main campus is located in Tempe within metropolitan Phoenix. The west campus, recently accredited by the North Central Association, serves western Maricopa County. ASU's total enrollment is over 43,000 students.

ASU is primarily a commuter school. About twenty-five per cent of our students are graduate students. A significant number of undergraduate students come to ASU with transfer courses. Over fifty percent of yearly transfer students come from the local Maricopa Community Colleges. ASU West offers primarily an upper-division curriculum so all its students have completed courses at other institutions. The information received on transcripts is an

integral part of many admissions decisions and used in academic decisions throughout our students' academic careers.

Technical Background

The central computing organization at ASU, Information Technology (IT), provides a wide variety of computing products and services. Centralized administrative computing is supported by two IBM mainframes: a 3090 500E and a 3084. Administrative student systems are developed in COBOL in an IDMS environment.

Data communications take place over a campus broadband backbone (ASCII packet and Ethernet) and via direct coax connected terminals using IBM SNA protocol. Most administrative computing uses direct connected terminals, but ASU is evolving toward a TCP/IP standard for Ethernet communications in both academic and administrative computing. ASU is connected to the Internet but has not used it for administrative data communications. ASU administrative systems use SUPERTRACS from Sterling Software to send/receive data to/from other organizations.

Administrative Applications Background

ASU's student applications are highly integrated, using a common Student Information Systems (SIS) database. SIS applications interface with business applications. These systems were developed in house by ASU technical staff. We expend significant effort in maintaining these systems. The electronic transcript sub-system is part of the Student Records and Admissions systems within the SIS.

LAYING THE GROUNDWORK

The groundwork for many changes occurs long before the change is envisioned. Your institution may have started the process toward electronic transcripts without realizing it. This was the case at ASU.

Academic Record in Electronic Form

Arizona State University installed a new Student Information System in 1980. One of the key differences in the new system was that the student's complete academic record was kept on the data base. The data base allowed on-line display of the transcript and the creation of a complete printed transcript. The new system had many benefits. The one that was important for the electronic transcript was that the academic record was stored in electronic form in one place.

Repository for Incoming Transcripts

The Arizona Board of Regents changed undergraduate admissions requirements for Fall 1987 admissions. The new requirements stated that incoming students must be competent in several subject areas. This new policy triggered a substantial revision to the Admissions systems at ASU. The revised admissions system captured information about the individual courses a student completed in high school or at other post-secondary institutions. The individual course information has benefitted evaluators and advisors. This system component was important for the electronic transcript project since it provided a place to store incoming transcript information in electronic form.

REPOSITORY FOR INCOMING TRANSCRIPTS

ELECTRONIC ACADEMIC RECORD

Figure 1

LOCAL EFFORTS

When Arizona State University began discussing electronic transcripts with its neighbors in the Maricopa County Community College District in 1988, we were not planning to change the world. We wanted to solve a local problem. Being close geographically, the two institutions serve many of the same students. Approximately 15,000 transcripts are sent back and forth each year between the colleges and the University. Admissions and Registrar offices have seen benefits from this local exchange. The benefits received from this local effort convince us to push for broader change.

To provide electronic transcript exchange, ASU made changes to its systems and procedures.

Data Communication Outside ASU

Arizona State University computers are connected to various other computing facilities. This connection has been primarily for academic activities and electronic mail. Connection outside of ASU for administrative computing was very limited. One method we had used was to dial-up another computer using a PC and modem. This worked but required operator intervention and the line speed of the regular phone line presented problems for large data transmission. To support the electronic transcript exchange and other data exchanges, ASU purchased SUPERTRACS in 1988. SUPERTRACS runs on

the IBM mainframe, supports unattended operation and connection, stores data received/sent from another computer, validates passwords, and provides security for administrative systems. SUPERTRACS benefits any administrative system which wants to connect outside the university.

Communications Network

Arizona State University and the Maricopa District Office were already connected by a dedicated phone line when we began electronic transcript exchange. The colleges within the Maricopa District were also linked to the District Office. The electronic transcript exchange used the existing network. Electronic transcripts became another use for an existing network.

Cooperation of Stakeholders

Exchange of electronic transcripts by definition implies a cooperative endeavor. Several work groups formed in the course of the project. Representatives from Undergraduate Admissions, Readmissions/Records, and Graduate Admissions met with computing services staff to determine how each office wanted to receive and process transcript data. Staff from ASU and Maricopa met to define transcript format and operations schedules. Computing services and admissions/records staff from both organizations met to review and confirm system tests. The project required many offices to examine their assumptions/procedures and reach consensus with others involved. The lessons we learned by working with each other improved our organizations. The cooperative spirit serves us as we continue to work together.

Format, Rules and Procedures

No national standard existed in 1988 when ASU and Maricopa began their electronic transcript exchange. Both institutions met to identify data included in their transcripts. We developed a format that included all the data included in either transcript. We also defined the expected and required content of each field. Procedures were developed for future review of the format. To accept the new electronic transcripts as official, required policy changes. The governing bodies for ASU, the Arizona Board of Regents, and the Maricopa Community Colleges, the Maricopa County Community College Board, accepted the electronic transcript as official. This set a precedent for the possible future exchange of other official documents.

System Revisions

ASU received incoming transcripts from Maricopa in phase one. To accept transcripts, we added a new sub-system. This system did

not change the existing admissions systems but added a new way of putting information into the system. New programs verified incoming transcripts, matched them with applicants/students, determined the interested office(s), printed the transcript or added transfer courses directly to the student record. Other new programs supported office staff by recycling unmatched transcripts, providing methods to manually match, post or print any transcript, and purging transcript files.

The second phase of the exchange had ASU send transcripts to Maricopa. We needed to enhance the transcript request process. Prior to the electronic transcript exchange, the transcript request process was limited to asking for copies of an individual student's transcript. Electronic transcript exchange was the impetus to revise the request process. Enhancements added the ability to request transcripts in the future, display requests on-line, produce computer generated addresses, track transcripts fees, and retain electronic data about transcript requests. Other new programs were added at the end of the transcript creation process to create transcripts in electronic format.

Trading Partners

The local exchange has been sending transcripts to ASU since 1989 and sending transcripts to Maricopa since 1991. One difference between this system and many other systems we use at ASU is that its continued success and operation relies not only on us but also on the Maricopa systems. ASU and Maricopa continue to communicate to ensure the smooth functioning of the system. We need to act as partners as we plan for future expansion and enhancement.

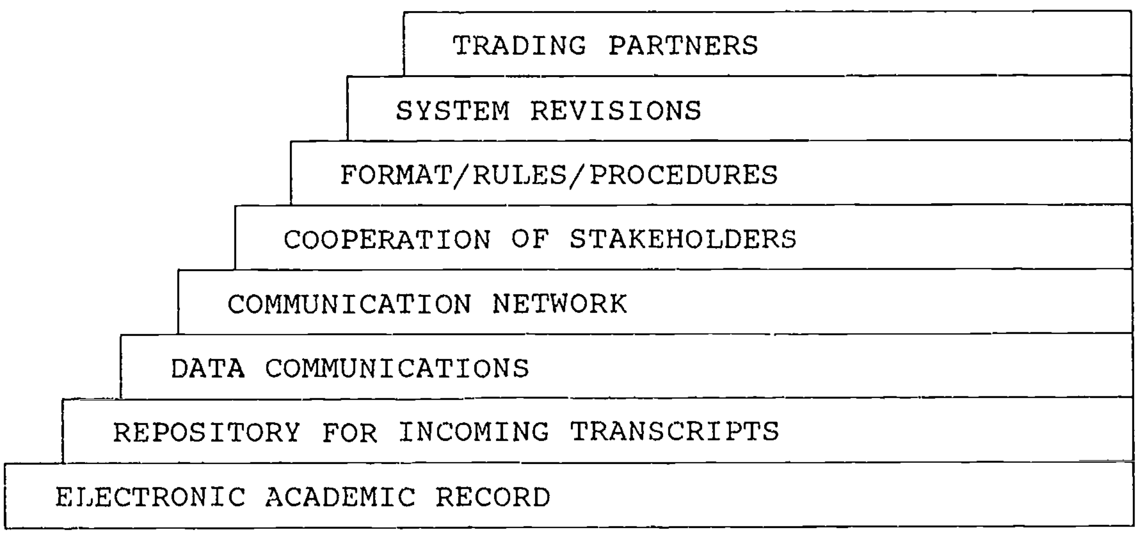

Figure 2

LOCAL BENEFITS

The electronic exchange of transcripts has brought benefits to both Admissions and Registrar's Offices. This exchange method: eliminates manual procedures to mail the transcript; cuts delivery time; provides automatic matching of over 95 percent of incoming transcripts; cuts time and errors associated with data entry; reduces postage and paper costs; and saves clerical effort and space needed to file paper documents. We have also discovered the ripple effect of improving our systems. Phone inquires are reduced. Turnaround for admissions and transfer credit decisions is lessened. Transcript request information is available more easily. Transcript requests are entered with a more even workload. We believe these initial steps are investments for greater benefits in the future.

NATIONAL EFFORTS

National Format

The American Association of Collegiate Registrars and Admissions Officers (AACRAO) appointed a task force in 1988 to develop standards for electronic exchange of educational records. This group along with a parallel task force created by the National Center for Educational Statistics developed a national standard to exchange electronic transcripts. The transaction set 130 was formally approved by the American National Standards Institute (ANSI) X12 committee in February 1992. For institutions starting the development of electronic transcripts, the presence of a national standard saves considerable time.

Arizona State University strongly supports the efforts to expand the number of institutions using the X12 standard. In 1992 we began a project to expand our current electronic transcript sub-system to use the national standard in place of the local format developed for the Maricopa exchange. To accomplish this, ASU purchased STX12, an EDI translation package, from Supply Tech. We modified an existing program to add data items needed by the national standard. We added new data communications procedures to connect to the GEIS (General Electric Information Services) network so we could transmit to others using the national standard. With these minor enhancements, we have been able to experiment with others piloting the new SPEEDE standard.

NEXT STEP

There are many next steps to advance the revolution in electronic data exchange. Arizona State University sees many next

steps for itself and others. Some definite next steps we have actively considered are:

* complete conversion of the Maricopa exchange to the national standard
* expanding the exchange to high schools in Arizona
* sending transcripts to the state Department of Education for teacher certification
* adding additional postsecondary institutions
* using the transcript as part of a transfer equivalency system
* expanding data exchange to other transactions.

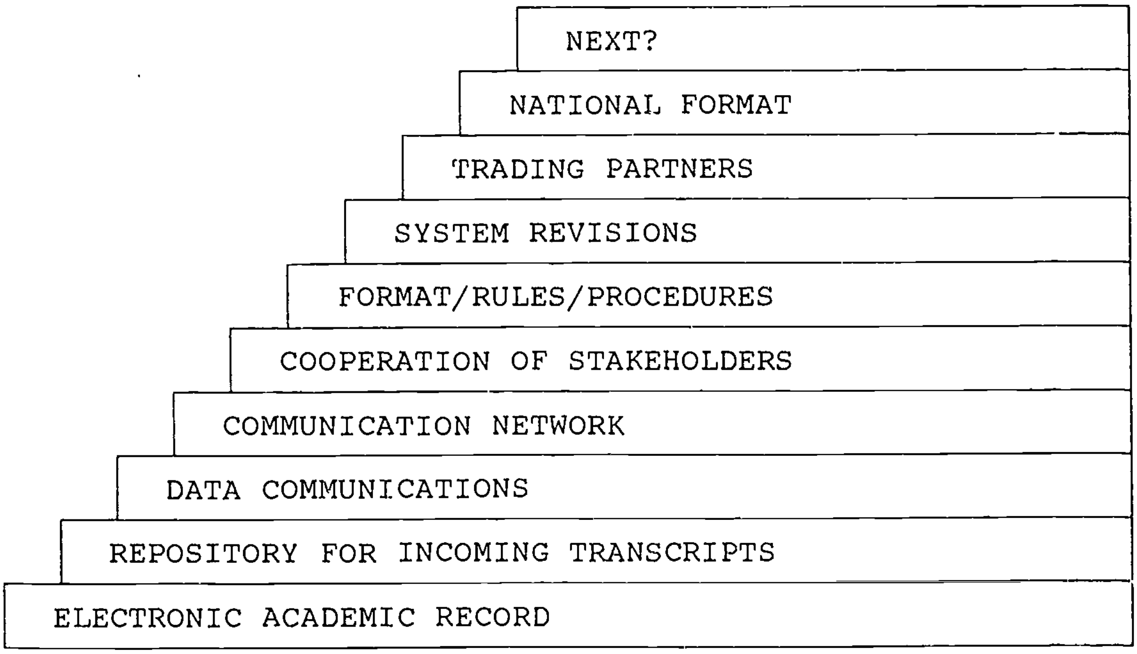

Figure 3

CONCLUSION

Arizona State has seen benefits as it has taken each step in this changing environment. Electronic data exchange is a technology which gives immediate benefit and builds an infrastructure for more benefits in the future.

As colleges and universities try to do more with less, ASU continues to invest in electronic data exchange. Other industries have demonstrated the benefits of this technology. It is only a matter of time before electronic transcripts are the primary method for sending educational records. That day will come more quickly

if other institutions add their talents and resources to the effort. Join the revolution.

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INFORMATION TECHNOLOGY: The Revolution Continues

STUDENT INFORMATION SYSTEMS

T2-2

Give Credit When Credit is Due: An On-Line Student Credit System Featuring On-Demand Checks

Marty Werneke
Central Missouri State University

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GIVE CREDIT WHEN CREDIT IS DUE: AN ON-LINE STUDENT CREDIT SYSTEM FEATURING ON-DEMAND CHECKS

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Central Missouri State University, founded in 1871, consists of 1050 acres located 50 miles east of Kansas City in Warrensburg, Missouri. Between the four colleges of Applied Sciences and Technology, Arts and Sciences, Business and Economics, and Education and Human Services, students may earn Associate, Bachelors, Masters or Education Specialist degrees from 150 areas of study. As of September 16, 1992 enrollment at Central was approximately 12,000. As with many universities, a large portion of that population is on some form of financial aid. At Central, this is generally around 55 - 60 percent.

The department of Information Services provides the university with a variety of computerized systems which support the university's administrative functions. A few of Central's major "in-house" developed on-line systems consist of:

Personnel/Payroll (1978, DL/I)
Student Registration (1968, VSAM)
Total Transcript (1981, DL/I)
Revenue (1972, VSAM and DL/I)
Financial Aids (1979, DL/I)
Facilities Inventory (1968, DL/I)

Within the past several years, Central has purchased and installed four package systems:

College and University Finance System
(CUFS, 1983, American Management Systems)
NOTIS (1984, Northwestern University)
Alumni Development (1992, Information Associates)
Degree Audit Reporting System (DARS, 1992, Miami University)

Management applications are supported by an IBM ES9121-210 Central Processing Unit with 64 Megabytes of memory. Central's mainframe operating systems is DOS/VSE/ESA. Peripherals include 1 IBM 3990 disk controller, 4 IBM 3380 high density disk drives, 3 IBM 3420 tape units, 1 IBM 7171 protocol converter, 1 IBM 3820 laser printer, 1 IBM 3203 printer, 1 STC line printer and a number of IBM 3174 terminal controllers. One of the 3174 controllers Includes a Token Ring backbone. Support is provided to over 600 devices through coax attachment, Token Ring and Apple Local Talk networks.

HISTORY OF STUDENT REGISTRATION AT CENTRAL

As listed above, Central's revenue/registration system is over 20 years old. This system

has served the university well, but as policies and procedures evolved, the system became increasingly harder to maintain. The student registration system allows pre-enrollment for the next semester to begin two weeks after the current semester starts. Students' fee charges are generated and/or adjusted immediately upon a change in enrollment. Residential life charges are also generated upon assignment to a residence hall. Several years after implementation of the registration system the financial aid system was added which allowed personnel to enter financial aid information as student award letters were returned. Students were able to pay their charges at any point in time *after* the charges were incurred. While this type of system may be miles ahead of the old port-a-punch and mass enrollment methods of the past, changes in policies and procedures resulted in many problems which had to be addressed.

Typically, there are always a very large number of enrollment (drop/add) changes for a student. Because of current file limitations, it became necessary for us, under certain circumstances, to purge courses that had been dropped by the student from on-line records in order to handle his current enrollment. Results were, of course, inaccurate reporting and potential fee calculation errors. Central's refund policy (first week - 75 percent, second week - 50 percent, third week - 25 percent) only compounded the difficulty in recalculating fees accurately. Tracking a student's financial record became difficult to say the least.

Loans, grants, and scholarships, were manually entered to a DL/I database as a student's paperwork was completed. The terminal operator was responsible for entering the amount for each type of aid/award. A "pre-run" report was produced two days prior to financial aid application. It became a manual effort at that point to review all students to determine whether or not adjustments were necessary. While those reviewing the report found many discrepancies, the potential for over-awarding was definitely present.

Another problem with the previous method of applying financial aid was the volume of checks which were voided each semester. An application run was made approximately every two weeks and checks were produced at that time. These signed checks would remain in the Revenue Office until either the students picked them up or financial administrators determined that they should be voided.

The student receivables billing also left much to be desired. Bills were printed on mailer forms which, because of space, limited the number of charges detailed to 12 and number of awards to five. Payments were never reflected. As a result, billing was much too vague and confusing.

SOMETHING HAD TO BE DONE!

It was decided that a "credit" system would be beneficial to the university's operation. Beginning spring '91, countless hours were spent by a committee of representatives from Revenue, Admissions, Accounting, Controller, Athletics, Student Affairs, Financial Aid, and Information Services in trying to define the "scholarship policy/credit" project. Federal regulations needed interpretation to determine how this new system should handle them. Priorities for the application order of awards/credits needed to be defined. A "conflict matrix" of valid award combinations and order of adjustment also required definition. Beginning in August 1991, the design phase of the student credit portion of the system also began. Programming started in late November, 1991.

There were several limitations within which we had to live including the decision to

implement the initial phase of the system for Fall of 1992. Because of pre-enrollment, that meant programming must be completed by February 3, 1992. With this short time frame, it became apparent that we did not have the time to totally rewrite the existing systems and we had to live within the file structures and data available at the time.

The new credit system was to also include third party credits (ie: vocational rehabilitation, veteran, etc.) as well as fee credits (refunds) and cash credits (payments made by the student). These new credit types and associated data were defined within new DL/I segments. One of the beauties of a DL/I database is the ability to define new segments without changing ALL existing programs.

The majority of the old revenue related on-line functions became a part of the new menu-driven system. Some of these functions include student receipting, entering/removing charges/credits, and loan repayments. A variety of existing inquiries were added to this menu as well as several new inquiries which aid the operator in determining the status of the student account. Figures 1, 2, 3, and 4 are a few inquiries which operators find very helpful.

Figure 1: **INQUIRE STUDENT BALANCE**

```
DOE JOHN            92/4 BALANCE DUE     1411.00 -   508-11-8930               FAREV166
CHARGES BALANCE DUE          $3,592.20      *    AVAILABLE CRED BALANCE        $5,003.20
 92/2 P  0052  09/17/1992     $743.20       *   CASH CREDITS                   $1,997.10
 92/4    0014  10/01/1992     $204.00       *   92/2  GSL                          $0.00
 92/4    005   10/01/1992     $204.00       *   92/4  GSL                        $998.10
 92/4    0052  10/01/1992     $895.00       *   92/4  PELL                     $1,200.00
 92/2    015   10/15/1992       15.00       *   92/2  001    10/22/1992          $208.00
 92/2    025   10/17/1992      $23.00       *   92/2  005    10/16/1992          $300.00
 92/4    001   10/22/1992     $680.00       *
 92/4    002   10/22/1992     $820.00       *
 92/4    001   10/28/1992     $208.00       *
**********************************************************************

      PF1 - PAGE FORWARD     PF2 - PAGE BACK             CLR - EXIT TASK
      PF6 - SUB-MENU         PF12 - MAIN MENU            PF3 - SET TAGS
```

The left side of this screen reflects the students charges on file up through the year/semester selected. The right side shows the available credits remaining through the year/semester selected. The top line will show the balance due to/due from the student.

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Figure 2: INQUIRE PAID CHARGES/CREDITS

SMITTY JOE 478-04-4621 FAREV084

YEAR SEM	$ TYPE	T	DATE CREATED	RECEIPT DATE	NUM#	RECEIVED CASH	RECEIVED CHECK	RECEIVED CR. CD.	RECEIVED IDT	AVAILABLE
922	PELL			10311992	CRED	0.00	0.00	0.00	525.00	0.00
922	ACHA			10311992	CRED	0.00	0.00	0.00	100.00	0.00
922	001			10311992	CRED	0.00	0.00	0.00	204.00	0.00
922	002			10311992	CRED	0.00	0.00	0.00	2210.00	0.00
922	005			10311992	CRED	0.00	0.00	0.00	861.50	0.00
TOTAL				10311992*	CRED*	0.00*	0.00*	0.00*	3900.50*	0.00
924	CASH			10261992	0425	0.00	28.01	0.00	0.00	28.01
TOTAL07				10261992	0425	0.00*	28.01*	0.00*	0.00*	28.01
924	CASH			10261992	F001	0.00	0.00	0.00	25.34	25.34
TOTAL07				10921992*	F001*	0.00*	0.00*	0.00*	25.34*	25.34
922	CASH			09041992	0347	0.00	1264.01	0.00	0.00	0.00
TOTAL02				09041992*	0347*	0.00*	1264.01*	0.00	0.00	0.00
922	CASH			08061992	0596	0.00	234.60	0.00	0.00	0.00
914	075		04071992	08061992	0596	64.44	0.00	0.00	0.00	0.00
914	015		04271992	08061992	0586	15.00	0.00	0.00	0.00	0.00
914	015		04291992	08061992	0596	15.00	0.00	0.00	0.00	0.00
914	075		05141992	08061992	0586	82.32	0.00	0.00	0.00	0.00

PLACE CURSOR ON LINE TO PRINT DUPLICATE

PF1 = PAGE FORWARD PF2 = PAGE BACK CLR = EXIT TASK
ENTER = PRT DUPLICATE PF6 = SUB-MENU PF12 = MAIN MENU

This inquiry will reflect all payments made by the student as well as any credit applications which have been posted to his account. Note: The receipt dated 10/31/1992 is a credit application. All credits applied are listed. The cash credit dated 10/26/1292 (receipt number F001) indicates a cash credit forwarded to a future semester. The student may elect to reserve all or a portion of his available cash credits held in reserve for another semester.

Figure 3: INQUIRE REFUND CREDIT ADJUSTMENTS

SMITTY JOE 92/2 478-04-4621 FAREV160

YR/ SEM	CREDIT TYPE	ORIGINAL DM	APPLIED DATE	EXCESS AMOUNT	BALANCE TO CASH	MAX AMT	VOIDED AMT DATE
92/2	002	07/29/1992	2,210.00	.00	.00	2,210.00	

A D J U S T M E N T S

TYPE	DESCRIPTION	DATE	SEQ	AMOUNT	MAX AMT.	CHECK	OPER
0	ORIGINAL ENTRY	07/29/1992	01	1,105.00	1,105.00		AD5
1	AUTO ADJUSTMENT	08/21/1992	02	1,105.00	2,210.00		A0C
4	BATCH CRED/FAIS	10/31/1992	01	2,210.00-	.00		

****

PF1 = PAGE FORWARD PF2 = PAGE BACK CLR = EXIT TASK
PF5 = SELECT SCREEN PF6 = RETURN TO SUB PF12 = RETURN MENU

An operator may view refund credits and cash credits. This screen displays a non-res credit of 2,210.00 and all adjustments which were made to arrive at that figure.

Figure 4: **INQUIRE APPLICATION INFORMATION**

```
DAILY MARGE                       10/29/1992         498-52-8879           FAREV188
    CREDITS  USED                      *                DISTRIBUTION
    TYPE             AMOUNT            *   YY/S  TYPE    CREATED     AMOUNT   H#
    PELL-CR          $1,125.00         *   92/2  001   04/08/1992   $1,088.00
    PERK-CR            $700.00         *   92/2  008   09/18/1992     $180.00
    SEOG-CR            $200.00         *   92/2  001   07/27/1992     $204.00
    001 -CR            $476.00         *   92/2  005   08/07/1992     $969.00 09
    005 -CR            $969.00         *   92/2  0052  08/07/1992     $555.00 15
    008 -CR            $250.00         *   92/2  080   09/04/1992     $509.00
    PERK-EX          $1,100.00         *
    CASH-CR             $50.00         *    EXCESS                  $1,100.00
                    ----------         *                           ----------
    TOTAL            $4,870.00         *    TOTAL                   $4,870.00
*********************************************************************************




  PF1 - PAGE FORWARD      PF2 - PAGE BACK         CLR - EXIT TASK
  PF5 - SELECT SCREEN     PF6 - RETURN TO SUB     PF12 - RETURN MENU
```

Once an application (or distribution of funds) has been made, the operator has available an inquiry screen which will display all credits which were applied to his account, all charges which have been paid by that credit, and also that amount of excess over and above his charges which has been moved to his cash credits for future use.

SECURITY

Security and a sufficient audit trail were two issues that were addressed during this project. The security program developed controls for the data entry of credits and charges. At the present time each charge type and/or fee credit type can be entered selectively by up to five offices and/or individuals. The program utilizes the CICS operator-id from the CICS SNT table in determining the terminal operator's clearance. All charges to a student account can be entered on-line by the area of responsibility. Fee charges, however, are automatically calculated at enrollment time. There are currently about 25 areas with this capability (i.e.: health center, airport, parking, residential life, etc.). Should this number need to be increased, it could be done quite easily. With regard to an audit trail, the terminal operator has available on-line, all third party credits, fee credits, and cash credits posted to the student's account, with all adjustments that have been made to each credit. Any on-line adjustments made will also have the operator's CICS operator-id recorded.

Another method of security added to the "remove charge" function prohibits removing a charge unless it was entered the same day. This was a requirement for the new billing procedure to be implemented in July. Charges which were entered and removed the same day are not shown on the student's bill. However, if a charge is entered one day and later the operator determines that the student is no longer responsible for the charge, they must enter a credit. At billing time, both the charge and the credit would be reflected. Another control measure taken by this security program is to prohibit the capability of entering/removing charges by the same area which receipts payments.

AWARD ADJUSTMENTS

As mentioned earlier, programming was developed that would automatically, on-line adjust a student's credits whenever any function was performed which might alter the amount available for each type of credit/award depending on the conflict matrix and rules developed. The adjustment program will find conflicts such as Distinguished Scholar and Foundation Merit, Regents-in-state and Regents-out-of-state, and Distinguished Scholar and Regents. In these situations, the student can not have both. In the case of the Distinguished Scholar(full ride) and Regents Scholarship, policy dictates that the maximum amount the student can receive is the "cost of education". Therefore, the student's Regents Scholarship will be adjusted to zero. Another example of this adjustment is PELL. If the student dropped below fulltime, such as 9 hours (this is considered 3/4 time at Central), programming would adjust the student's PELL award to 75% of the original award. Charges/credits entered will also invoke the adjustment program to review the student's account and made necessary adjustments.

STUDENT RECEIPTING

There are several receipting functions which may be performed in the revenue office. The one referred to in this paper pertains to the student receipting function. To begin with, the system is capable of maintaining 35 separate drawers (receipting stations) during the day. Each operator has the capability to check at any point during the day to determine the current drawer balance. Totals to which the operator must balance include: cash received, special deposits, credit card payments (electronically processed), credit card payments (manually processed), checks received, and inter-departmental transfers. (Figure 5) Once each operator has balanced their "drawer" an operator can display a deposit screen (figure 6), print screen the image, and use that to accompany the daily deposits to the bank.

Figure 5: OPERATOR DRAWER BALANCE

FAREV098

	GENERAL FUNDS	FOUNDATION FUNDS	TOTAL
CASH -	$165.90 -	$0.00	$165.90 -
SPECIAL DEPOSIT	$15,983.40	$0.00	$15,983.40
EDC MC/VISA/DIS	$0.00	$0.00	$0.00
MASTERCARD/VISA	$0.00	$0.00	$0.00
CHECK -	$18,090.60	$2,000.00	$20090.60
IDT -	$0.00	$0.00	$0.00
GENERAL TOTAL	$33,908.10	$0.00	$35,908.10

DRAWER NUMBER IS ALL - TSMITH

DRWR 01		DRWR 13		DRWR 25	
DRWR 02	$15,677.79	DRWR 14		DRWR 26	
DRWR 03		DRWR 15		DRWR 27	
DRWR 04	$5,675.89	DRWR 16		DRWR 28	
DRWR 05	$11,446.22	DRWR 17		DRWR 29	
DRWR 06		DRWR 18		DRWR 30	
DRWR 07	$1,108.20	DRWR 19		DRWR 31	
DRWR 08		DRWR 20		DRWR 32	
DRWR 09		DRWR 21		DRWR 33	
DRWR 10	$0.00	DRWR 22		DRWR 34	
DRWR 11		DRWR 23		DRWR 35	$2,000.00
DRWR 12		DRWR 24		TOTAL =	$35,908.10

PF6 - TO RETURN TO SUB-MENU PF12 - TO RETURN TO MENU

An operator may at any point in the day display their particular drawer balance or the balance of all receipting stations broken down by funds (general or foundation) and by method of payment. The bottom half of the screen reflects the total amount receipted for each station.

Figure 6: **DAILY DEPOSIT SHEET**

REVENUE DRAWER TOTALS FOR THE DAY OF 11/03/92		FAREV171
TOTAL OF DRAWER TRANSACTION		33,989.85
LESS GENERAL SPECIAL DEPOSIT	-	16,015.15
LESS CMSU FOUNDATION SPECIAL DEPOSITS	-	0.00
LESS CMSU FOUNDATION	-	0.00
SUB TOTAL		17,974.70
LESS GENERAL EDC CREDIT CARDS	-	0.00
LESS CMSU FOUNDATION EDC CREDIT CARDS	-	0.00
TOTAL DEPOSIT FOR ALL CASH DRAWERS		17,974.70
********** GENERAL FUNDS BANK DEPOSIT TOTALS FOR		**********************
CHECKS		18,140.60
MANUAL CREDIT CARDS	+	0.00
CASH	+	165.90 (-)
TOTAL DEPOSIT		17,974.70
************ FOUNDATION FUNDS BANK DEPOSIT TOTALS FOR		******************
CHECKS		0.00
MANUAL CREDIT CARDS	+	0.00
CASH	+	0.00
TOTAL DEPOSIT		0.00
		0.00
PF6 - TO RETURN TO SUB-MENU	PF12- TO RETURN TO MENU	

When all receipting stations have balanced their drawers an operator may display the above screen, screen print and then attach it to the daily bank deposit.

As with the previous revenue receipting function, students have always had the facility to make payments directly to their account at any point after their charges have been incurred. We have now taken this a step further by allowing the student to pay in advance, on their account, money to be applied to their charges at a later date. These are referred to as "cash credits".

While tightening many of the controls, the receipting function still maintains a lot of flexibility. As the student is processed, programming will send a variety of messages to the operator depending on the status of the student (ie: suspended/dismissed, records on hold, collection agency account, etc.). The first common screen which is returned, however, on every student is one which will indicate all loans, grants, scholarships, fee credits, third party billing credits and cash credits available, as well as the total outstanding charges. The operator then has a variety of pathways which may be taken while continuing the receipting process.

Ideally, the student's payment will be recorded as a cash credit. If, however, the need arises, specific charges (ie: telephone bill, parking fine, etc) may be selected for direct payment. The philosophy taken at Central is that it really doesn't matter what charges have been paid or not paid, but only that sufficient credits are available to cover the student's charges. In fact, controls have been developed which will prohibit enrollment fees from being directly paid. The only way current semester fees can be paid is during batch application of credits. An application run, to distribute revenue to the appropriate accounts, is made approximately once per month throughout the semester.

The next common screen that all revenue operators will receive regardless of the pathway chosen will allow the operator to indicate the amount of payment and method of payment. (Figure 7) This particular screen contains all the information the operator needs to know to

complete the function, whether it is receipting a payment, or making a cash withdrawal for the student against his/her available credits.

Figure 7: RECEIPT PAYMENT/CASH WITHDRAWAL

```
SMITTY JOE                   YEAR/SEM - 92/2   478-04-4821          FAREV000
TOTAL OUTSTANDING CHARGES TO DATE              (      .00)          1,929.80
ACTUAL CREDIT AVAILABLE TO DATE                (      .00)          1,847.30
TOTAL ESTIMATED CREDITS AVAILABLE TO DATE      ( 1,700.00)          1,800.00
UNAUTHORIZED PELL AVAILABLE                                           250.00
                                                                 -----------
 ESTIMATED BALANCE PRIOR THIS SESSION                             ( 1,667.80 )
RECEIVED THIS RECEIPTING SESSION
     CASH RECEIVED -            ------,--
     CHECKS RECEIVED -           300.00  ELECTRONIC
     CREDIT CARD -              ------,--   -
     IDT RECEIVED -             ------,--    TOTAL-     300.00
CHARGES PAID THIS SESSION                                 0.00
                                                   -----------
AMOUNT AVAILABLE FOR CREDIT THIS SESSION                300.00
     INDICATE AMOUNT TO CREDIT THIS SESSION                           250.00
CASH BACK TO STUDENT                                                   50.00
                                                                 -----------
     MAXIMUM ADVANCE POSSIBLE           (  600.00 )                 1,917.50
        PAYMENT PRESENTED (T,M,P)  -     P

 ENTER ONE OF THE FOLLOWING TO CONTINUE PROCESSING:

ENTER - CALCULATE TOTALS       PF1 - CONTINUE PROCESSING
PF6 - CANCEL/RETURN TO SUB-MENU   PF11- PREVIOUS    PF12-CANCEL/RETURN MAIN MENU
```

There is a lot of information on this screen to enable the operator to determine the next step to take. The amounts on the top 25% of the screen are not changeable by the operator. If the student is making a payment, the operator must enter the amount at the location indicated in the middle of the screen. The maximum advance possible is calculated based upon the operator's security, and payments made during that receipting session. The amounts reflected in parenthesis are informational only. (In this example the 1,700.00 is the amount of GSL for which the student has been approved. Six hundred dollars is then the amount of open cash advances the student has remaining on file)

There are sufficient controls within the receipting function which do not allow the operators to advance more than the student's credit balance (charges less credits). Two LOGONS have been established which will allow the operator the ability to override the controls and allow advances up to the total credits available regardless of outstanding charges. These logons are seldom used but do accomodate circumstances where family housing is charged by the semester and are paid in advance EXCEPT when government loans may be credited in two payments. If the second check from the loan has not been received it is not required that ALL housing for the semester automatically be paid from the first check. (FIGURE 8)

Figure 8: RECEIPT PAYMENT/CASH WITHDRAWAL (OVERRIDE LOGON)

```
 SMITTY JOE                    YEAR/SEM  - 92/2   478-04-4621                FAREV090
TOTAL OUTSTANDING CHARGES TO DATE                (      .00)               1,929.80
ACTUAL CREDIT AVAILABLE TO DATE                  (      .00)               1,847.30
TOTAL ESTIMATED CREDITS AVAILABLE TO DATE        ( 1,700.00)               1,500.00
UNAUTHORIZED PELL AVAILABLE                                                  250.00
                                                                         ----------
 ESTIMATED BALANCE PRIOR THIS SESSION                                   ( 1,667.50 )
RECEIVED THIS RECEPTING SESSION
     CASH RECEIVED -              ------,--
     CHECKS RECEIVED -            300.00  ELECTRONIC
     CREDIT CARD -                ------,--    .
     IDT  RECEIVED -              ------,--    TOTAL-    300.00
CHARGES PAID THIS SESSION                                  0.00
                                                     ----------
AMOUNT AVAILABLE FOR CREDIT THIS SESSION                 300.00
     INDICATE AMOUNT TO CREDIT THIS SESSION                                  250.00
CASH BACK TO STUDENT                                                          50.00
                                                                         ----------
     MAXIMUM ADVANCE POSSIBLE            (  600.00 )                       2,747.30

    PAYMENT PRESENTED (T.M.P)  -      P

 ENTER ONE OF THE FOLLOWING TO CONTINUE PROCESSING:

ENTER - CALCULATE TOTALS          PF1 - CONTINUE PROCESSING
```

This display is basically the same as figure 7, however, in the case where one of the two "override" operators is logged on, the maximum advance possible will be the sum of all credits available (1,667.50), all deposits made during that receipting session, less all open cash advance that the student has already received since last application (600.00).

Anytime a check is issued, a corresponding charge is created on the student's account. This charge is then paid at the time the application of credits is made. Figure 9 and 10 reflect the "receipt" screen and the "check issued" screen which can be screen printed and given to the student. The receipt screen shows the amount which was credited to the

Figure 9: STUDENT RECEIPT

```
                               CENTRAL MISSOURI STATE UNIVERSITY
491-32-4582                     WARRENSBURG, MISSOURI  64093
DOE JOHN                                               BALANCE OF ACCOUNT
198 S.W. 13 HIGHWAY                       SEM  TYPE   DESCRIPTION              AMOUNT
ROUTE 3F                                  911  0041   DROP CHARGE               12.33
CEDAR RAPIDS IA     48521                 902  015    TRAFFIC FINE             100.00
                                          912  015    TRAFFIC FINE               3.50

 TOTAL RECEIVED      -         125.00
  CHARGES PAID       -         115.83
  CREDITS        -               0.00
                           ----------
  CHANGE                         9.17

 TOTAL REMAINING CHG           669.98
 CHECK ISSUED       +          350.00
 TOTAL AVAILABLE CRED  -      3500.00
                           ----------
  DUE FROM STUDENT         ( 2,480.02 )

METHOD OF PAYMENT - CSH CK CRCD IDT
VALIDATION     - YES 92/2
PREPAYMENT     - NO    NEXT SCHEDULED                 OTHER
FULLPAYMENT    - YES   PAYMENT DATE                   TOTAL CHARGES PD.          115.83
RECEIPTED BY       - 01                    ISSUED - 10/16/1992  NO. 3216  09:46:32
```

The above display is that of a students receipt for a payment which he has made. The right half of the receipts lists all charges which were paid directly by the student. The left portion indicates the amount received from student, total charges selected, amount deposited as credit and any change returned to the student.

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Figure 10: CHECK VERIFICATION

```
                              CENTRAL MISSOURI STATE UNIVERSITY
491-32-4682                    WARRENSBURG, MISSOURI 64093
DOE JOHN                                               BALANCE OF ACCOUNT
188 188 S.W. 13 HIGHWAY                    SEM TYPE DESCRIPTION              AMOUNT
ROUTE 3F                                   922 0016  INTERNATIONAL EXCHAN    504.00
CEDAR RAPIDS IA    48521                   922 001   FEES UNDERGRADUATE      165.98

COPAY- BOATMANS BANK
 TOTAL OPEN CHARGES          669.98
 CHECK ISSUED        +       350.00

 ACTUAL CREDITS      -      1897.75
 ESTIMATED CREDITS   -         0.00
 GSL/FNDB/FNDC       -      1802.25
 UNAUTHORIZED PELL   -         0.00
                           ----------
 ESTIMATED CREDITS         ( 2480.02 )

  CHECK NUMBER - 00000010345
 NEXT SCHEDULED PAYMENT - 12/01/92
VALIDATION     - YES 82/2
PREPAYMENT     - NO
                                              OTHER                         0.00
FULLPAYMENT    - YES                           TOTAL OPEN CHARGES         669.98

                        ISSUED - 10/15/1992   BY - 01                  09:46:32
```

When the student makes a withdrawal against his available credit balance, the above screen is returned and may be screen printed and given to the student. He then has "authorization" to receive the check from the employee stationed at the check printer. Additional information on this receipt includes a list of all remaining charges on his records. If a check is drawn in two names, the copayee is also indicated.

student's account and any charges which were directly paid. The "check issued" screen indicates the check number and amount of check, the payee and copayee, and also the remaining charges on the student's account. This screen, when printed and given to the student, is also used as verification to the employee responsible for handing the check to the student, that he indeed is the person to receive it. Central purchased a TROY 410 laser printer to print the on-demand checks. The paper utilized is 8 1/2 X 11 inch with two horizontal perforations. The top (approximately 1/3) is in blue security stock with the remainder in standard white paper (20 lb.). The check number is a system maintained sequential number. The check form, variable data, check number, MICR code and signature are printed on the blank check form after the operator completes the student receipting function. The signature is controlled with the use of a signature font card and key (figure 11). The bottom 1/3 of the check is a duplicate with the exception of the micr code and signature. The student must then sign on the bottom 1/3 of the form. This portion then accompanies the day-end check register to the accounts payable office.

The TROY printer is an ASCII device and therefore has to be attached to our mainframe through a protocol converter. We have an IBM 7171 unit to which the TROY printer is attached. The connection from the IBM 7171 unit to the printer is supplemented with a LONG-LINK unit which extends the RS-232 length to a greater distance, and uses 4 twisted pair telephone wires. The TROY printer is driven with our system software as a standard 3270 type printer.

IMPLEMENTATION

The fee credit system was implemented in four stages. The first stage was implemented on February 3, 1992. When fall 92 enrollment began, programming was in place to enter

and/or adjust fee credits. The same coding structure was used for the credit type that was used for charges. For example, incidental fees are '001 ' charges so the credit for fees is a '001 ' credit type. This allowed for use of our existing Revenue Distribution Database to determine the accounts to use in the interface to the CUFS accounting system. The automatic on-line adjustment program was also installed at this time and course enrollment was moved from the VSAM file to the DL/I database eliminating the course purge problem we were having. Also implemented was the change in the method of recording housing and enrollment charges/credits. We changed from adjusting one single enrollment charge per semester and concurrently updating date of transaction (leaving no trail available on-line) to adding charges on upward enrollment hours and credits for downward movement in enrollment hours. This was also necessary in order to create the type of student billing statement desired.

On July 14, Central sent the fall semester 92 student billing utilizing the new billing format. This has proven to be a big adjustment for both the students and Central staff. The students are receiving statements which reflect all activity in detail whether it is charges generated, payments received, or credits issued. The statement also reflects all estimated credits available (GSL, PELL, Scholarships, etc.) up through a given year/semester. Also calculated is the amount of prepayment which the student must pay in order to retain classes. (Central requires a $100.00 prepayment or the students courses will be removed on pre-scheduled dates in an effort to free up seats for other students.) The student's statement is printed on 8 1/2 by 11 inch standard stock form using the IBM 3820 laser (figure 12). The new security program which controls the areas which may add charges/credits was also installed on July 14.

August 28 was the date the new check writing function was implemented. This enabled the terminal operator to issue the on-demand checks to the student for any excess credits they had on their account.

On October 31, Central processed the first application of student credits to student charges and distributed those funds to the general ledger. The application process utilizes the prioritization table of credits and order of charges, paying the charges with the credits available to the student and moves any excess credit remaining to the student's cash reserve. Excess credits are moved to cash in order to clear the various credit accounts and distribute the money from these accounts. The excess moved to the student's cash account may be held to cover future charges or be withdrawn by the student on request.

At the point in which credits are applied to the student's charges any "cash advance" charges will also be covered. The only exception to this is within the PELL program. Our interpretation of federal regulations show that PELL monies may only be used for fees and housing unless the student authorizes the university to use the remainder to pay other charges. Therefore, if a student's records show that he has not given the university that authorization, that portion which exceeds his fees and housing is held in the PELL account for student withdrawal. If it had been added to his cash credit, the money could have been utilized to pay other miscellaneous charges. The unauthorized amount remaining is subject to application should the student incur more charges which could be considered fees and housing. The revenue receipting function also keeps track of those amounts of authorized and unauthorized PELL the student is to receive. Also implemented was the interface which distributed the funds to the appropriate accounts in the CUFS system. Manual data entry is no longer necessary for posting to the general ledger.

Figure 11: CENTRAL MISSOURI STATE UNIVERSITY CHECK

Central Missouri State University
Warrensburg, MO 64093

10-117
1010
Through
CITIZENS JACKSON COUNTY BANK
WARRENSBURG MO

DATE	VENDOR NO.
11/10/92	499-70-9120

NO. 905291

ONE THOUSAND EIGHT HUNDRED SEVENTY DOLLARS AND NO CENTS

AMOUNT
****1,870.00

PAY TO THE ORDER OF

RILEY MELINDA R.
113 EAST WALNUT

CHILHOWEE, MO 64733

⑈905291⑈ ⑆101001377⑆ 20001337⑈01

DETACH AT PERFORATION

DATE	VENDOR INVOICE	PAYMENT VOUCHER	DESCRIPTION	AMOUNT
11/10/92			STUDENT CREDIT RILEY MELINDA R. 499-70-9120	****1,870.00
			AMOUNT OF CHECK	****1,870.00

NO. 905291

Central Missouri State University
Warrensburg, MO 64093

DETACH AT PERFORATION

Central Missouri State University
Warrensburg, MO 64093

DATE	VENDOR NO.
11/10/92	499-70-9120

NO. 905291

PAY TO THE ORDER OF

RILEY MELINDA R.
113 EAST WALNUT

CHILHOWEE, MO 64733

AMOUNT
****1,870.00

NON-NEGOTIABLE

02

The figure above is an image of the check drawn to a student as a cash advance against his available credits remaining through a given year/semester. He must sign on the line at the bottom. This is retained by accounting as a duplicate check.

Figure 12: CENTRAL MISSOURI STATE UNIVERSITY STUDENT STATEMENT

MCDONALD RONALD — ACCOUNT: 491-92-8163 — BILLING DATE: 10/28/1992

BEGINNING BALANCE	ADDITIONS	CREDITS	ACCOUNT BALANCE
$250.00	+ 1,115.00	+0.00	$1,365.00

CURRENT PAYMENT DUE (THROUGH FALL/1992)	+615.00
*LESS ESTIMATED AWARDS (THROUGH FALL/1992) -	0.00
MINIMUM PAYMENT DUE	+615.00
TOTAL PAYMENT NOW DUE	+615.00

LUNSFORD ED
CMSU
HUMPHREYS 212 BLDG.
WARRENSBURG, MO 64093

AMOUNT REMITTED

CUT ALONG DOTTED LINE AND REMIT ABOVE PORTION WITH CHECK OR MONEY ORDER TO CMSU

CENTRAL MISSOURI STATE UNIVERSITY - STATEMENT OF ACCOUNT — 491-92-8163

DATE	SEM/YEAR	DESCRIPTION	ADDITIONS	CREDITS	BALANCE
02/01/1992		BALANCE FROM LAST BILLING			+250.00
06/18/1992	FALL/92	HOUSING, ROOM ONLY	200.00		
06/21/1992	FALL/92	HOUSING, ROOM ONLY	200.00		
06/22/1992	FALL/92	FEES GRAD.	250.00		
06/24/1992	FALL/92	FEES GRAD.		150.00	
06/29/1992	FALL/92	FEES UNDERGRAD.	250.00		
07/15/1992	FALL/92	PAYMENT RECEIVED	350.00		
08/24/1992	FALL/92	HOUSING,ROOM ONLY	200.00		
09/28/1992	FALL/92	PARKING FINE		15.00	
09/29/1992	FALL/92	PAYMENT RECEIVED		100.00	
10/02/1992	FALL/92	TRAFFIC FINE	15.00		
10/19/1992	SPRING/92	FEES GRAD	950.00		
		ACCOUNT BALANCE	+2813.00	615.00	+2448.00
	FALL/92	ESTIMATED AWARD/AID - PTYO		80.00	
	FALL/92	ESTIMATED AWARD - PELL		$1200.00	
		*TOTAL ESTIMATED AWARD/AID		+1280.00	
		TOTAL OWED	+2813.00	+1895.00	+1168.00

PAYMENTS SHOULD BE POSTMARKED BY JULY 31, 1992.

This new billing statement describes the current status of your account. Please review carefully the charges on this statement as they will appear only once. Future statements will show this ending balance as the new beginning balance plus new activity on the account.

Unless you have made prior arrangements with the Revenue Office, pay the "total Owed" plus any options you wish to select. Cut off the top portion indicated and return with your payment to:
CENTRAL MISSOURI STATE UNIVERSITY REVENUE OFFICE, WARRENSBURG, MO. 64093. (816)-543-4117

To retain your class schedule and be validated for attendance, full payment should be postmarked by July 31, 1992 and received in the Revenue Office by August 6, 1992. If your estimated award/aid exceeds your account balance a payment is not required. The top portion of the statement must be returned to request validation. Students with credits in excess of charges may pick up a check for the difference at the Revenue Office after September 1, 1992.

The sample student statement in figure 12 reflects all charges incurred and credits received since the last time the student was sent a statement. The top portion is returned with the payment and reflects that portion of the students charges which are immediately due upon receipt. Although charges for future semesters may have been incurred, they are not required to be paid until the first billing cycle of a semester. The bottom portion is a free text area and may be used for special instruction.

BEST COPY AVAILABLE

INTERFACES

As mentioned previously, charges are entered on-line by each area of responsibility. There are, however, times when the volume is so great that it was much more advantageous to develop an interface which would automatically upload data to the student's account. On a daily basis, we now upload all student parking fines issued for the day from a PC based system called TICKETTRAC. Library fines are also uploaded from the NOTIS system to the revenue fee credit system. On a monthly basis, telephone charges (one per student) are uploaded and posted to the student's account. (The detailed statement sent to the student is generated from a PC based system from COMPCO, uploaded to the mainframe and then printed on the mainframe.) The total amount is then posted to the student's account and is billed utilizing the new billing format implemented in July. Residential Life also uploads housing contracts (charges) once per semester.

Periodically, Central automatically removes students from their enrollment for one reason or another, typically for non-payment or non-validation. When this is done the proper credits are generated to the student. Following any batch processing which might affect a student's credits, a batch credit adjustment program is run to process the student records to insure that all credits are adjusted to the proper amounts. (ie. PELL, Regents, etc.).

The interface to CUFS (accounting system) is run daily during off-hours for all payments receipted, and then again after each application of credits. At this time the distribution is made from the appropriate credit accounts (PELL, Perkins, Voc. Rehab., etc.) to the appropriate revenue, expense and/or balance sheet accounts.

REPORTS

There are a variety of reports within the new credit system. Daily the student monies received will be reported in a revenue ledger. All documents generated within the interface to CUFS will be reflected in a daily document report. Also, an exception report of all checks issued to someone other than the student will be printed and reviewed. On a monthly basis a report is produced for all checks issued by the "override" operators. And, on-request, a variety of reports concerning credit available and balance of student's accounts are available.

IN SUMMARY

Much programming was accomplished in very little time, but not without a great number of hours of work by the programming staff at Central. We have, however, made many significant gains for many areas on campus. Some of the benefits of this system are listed below:

1. There are ***NO*** student financial aid, refund, or cash advance checks written in batch processing, virtually eliminating the large number of voided checks.
2. There are no signed checks sitting around waiting to be misplaced.
3. Funds are no longer taken from CMSU accounts until the on-demand check is cut.
4. All credit adjustments are made automatically on-line allowing operator's to have an accurate view of the student's account at any time.
5. The possibility of overawarding is virtually eliminated because it no longer requires manual adjustments.

6. The system allows pre-payment by students before charges are incurred.
7. Specific credits (ie. parking) pay charges of the same type using the priority and order of application tables.
8. Student cash credits are applied to oldest charge first, thus clearing and improving the accuracy of the aging report.
9. Less paperwork - Payment vouchers no longer necessary for issuing refund checks.
10. Refund data is entered by area authorizing refund, thus eliminating disbursements data entry by accounts payable staff.
11. Better audit practice because of the enhanced security which has been built into the system.
12. Greatly reduced the number of refunds necessary each semester. Application of credit not made until end of refund period.
13. Sufficient records are available on-line to enable operator to track adjustment history of third party, fee and cash credits allowing for a much better audit trail.
14. Aids in reducing the receivables - The opportunity is there to collect on all student's receivable prior to allowing a cash advance on remainder of credit available.
15. Tighter security.
16. As disbursements are made each student signs on the check stub, which is retained in the accounting area for control and issuance of duplicates, if necessary.
17. Reduces the number of checks written because refunds for housing deposits, parking permits, returned books, and fees are all posted to the student's account and one check can be written rather than one check for each refund type.

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San Antonio

INFORMATION TECHNOLOGY:
The Revolution Continues

STUDENT INFORMATION SYSTEMS

T4-2

An Easy and Convenient System for Administering and Managing Personal Identification Numbers (PINs)

Edward M. Svegal
Genene C. Walker
Arizona State University

38th Annual
College and University
Computer Users Conference

Hosted by Baylor University
in San Antonio

May 9–12, 1993

An Easy and Convenient System for Administering and Managing Personal Identification Numbers (PINs)

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INTRODUCTION

Arizona State University continually strives to provide secure, convenient and quality student services. More than 90 percent of our 43,000+ students commute to either the ASU Main campus in Tempe or to the ASU West campus in Phoenix. To better serve this large student population, ASU has successfully integrated touch-tone telephone, voice response and computer technologies. The resulting system is InTouch, ASU's Interactive Voice Response (IVR) Registration and Fee Payment System.

The required entry of a Personal Identification Number (PIN) helps insure a secure access method to InTouch. A PIN assists in: 1) Authenticating the identity of the caller; 2) preventing unauthorized access to student information; 3) insuring privacy of student data.

HARDWARE/SOFTWARE CONFIGURATION

The InTouch system consists of two Syntellect, Inc. Emperor cabinets housing a total of 120 telephone lines. Terminal connection is through an IBM 3745 controller to a mainframe IBM 3090 500E host computer. The Student Information System (SIS) database was developed in-house in 1980, using the IDMS database management system. The on-line registration and fee payment systems are programmed in COBOL and COBOL II using the IDMS/DC Teleprocessing Monitor. In 1990, the PIN on-line screens were programmed in ADS/O.

The mainframe PIN application communicates between a caller on a telephone and the SIS database using the IVR as an interface. The application has three components: 1) Verifying caller's identity; 2) changing student PINs if needed; 3) logging data items and tracking PIN activity.

INTOUCH PILOTS

Less than 10 percent of the students began using InTouch in a short, three week pilot in the fall of 1990 for spring 1991 registration. The second pilot was conducted the following semester and ran for three months. During the second pilot InTouch was available to about 30 percent of our students. InTouch was available to all students fall 1991 for spring 1992 registration and fee payment. Initially used by students for class registration and drop/add, it has since been enhanced to include:

- class availability status
- registration fee information
- payment refund requests
- tuition fee payment via credit card, debit card and financial aid

Post pilot reviews were conducted with the Registrar's Office, the Student Fee Payment Office and Computer Accounts' Office (CAO). The CAO is responsible for controlling access to ASU's mainframe computer systems. The Registrar's Office summarized feedback from staff, faculty and students. Feedback was very positive. The most often heard comments from students are how easy and convenient InTouch is to use.

One issue that surfaced was unfamiliarity and confusion over entry of the PIN. An unexpected surprise was that most students did not know what PIN means. We made the assumption that students would have experience using bank cards at teller machines. We quickly learned most students have never been exposed to the concept of PINs. We changed the phone session to speak the phrase "Personal Identification Number" rather than the acronym "PIN". A phrase was added to tell the caller that changing the initial PIN on first use is a security measure. Another phrase explains a new password has to be entered twice to verify the correct number was keyed on the first attempt. Many callers did not perceive the PIN as a password. These changes, plus the fact students became aware that the PIN instructions were in the Schedule of Classes, have significantly reduced the number of calls for PIN assistance. Attachment A is a sample of the current script spoken to callers requesting entry of the ASU-ID and PIN.

ADMINISTERING PIN's

We researched information about PIN applications at other universities. A few universities reported using PINs, with few or no problems. A very conspicuous PIN, like the student's birth date, seemed to be used most often.

At ASU, callers are requested to enter their nine digit ASU-ID number and their four digit PIN. Every student's PIN is initially set to the month and day of their birth date in the SIS. Forced change of the initial PIN is used for added security.

Business procedures before InTouch made walk-in photo identification an acceptable way of verifying student identification. A major goal of InTouch is to reduce student trips to campus. The student may be off campus, often out of state, when using InTouch. They may need quick resolution to PIN problems in order to get needed classes. Assisting students with forgotten PINs, PIN change requests and PIN related questions needed to be handled by phone as well as in person.

A balance was found between convenience to students and legal/security issues. The primary consideration in administering PINs is to provide fast convenient service yet, maintain adequate safeguards against tampering and protect the privacy of student information. Great care should be taken to not reveal information about the student or a student's records to a caller, who may be an imposter. Enough questions must be asked to be convinced the correct student is on the phone.

Because servicing PINs takes resources from whatever department is the administrator, it is important to keep the procedures fast and easy. ASU's PIN System is administered by both the Registrar's Office and the CAO. Figure 1 shows the screen used to assist students with questions or to reset PINs back to the initial PIN (birth date). Each session to assist a student is logged as either an inquiry or a reset, but not both. There is only one incremental count for a given session with a student. The PIN is never displayed. The field "NEW PIN REQUIRED NEXT TTS ACCESS:" indicates whether the student is set-up for a forced PIN change their next call to InTouch, or if their existing (non-birth date) PIN must be entered.

```
RGTT110F  TOUCH-TONE TELEPHONE SYSTEM (INTOUCH)  11/10/92
LTERMID: CV200010      PIN CHANGE                13:03:58

TASK:RGTT01  ID:468-46-2005  USER OFFICE:REG (REG OR CAO)

                   DIRECTORY RELEASE:

NEW PIN REQUIRED NEXT TTS ACCESS: Y

ID NUMBER: 468-46-2005        LAST PREVIOUS INSTITUTION:
NAME: SMITH, JOHN C             NAME: ROLLINS UNIVERSITY
LOCAL ADDRESS:                  STATE: MN
   740 EAST APACHE TRAIL        LAST YYMM: 89 06
   UNIT 5                     HIGH SCHOOL:
   TEMPE        AZ 85026        NAME:
PERMANENT ADDRESS:              STATE:
   10105 SEWARD HWY             GRADUATION YEAR:
   WESTFIELD    NY 00034
   UNITED STATES              RESIDENCY: NEW YORK

LOCAL PHONE: 602-555-5555

BIRTH DATE: 01-29-53     LAST VALID TTS ACCESS: 08-25-92

ACTION:
ENTER = STUDENT INFO                PF3 = PIN HISTORY
PF5   = RESET PIN                   PF6 = OVERRIDE DIR INFO
PF10  = PREVIOUS MENU    PF11 = MAIN MENU     PF12 = QUIT
```

Figure 1. PIN inquiry and reset screen

Individual student history of PIN transactions and resets are available on-line. Figure 2 is an example of the PIN CHANGE HISTORY screen for a student. The screen displays:

- the number of times a valid access was made with the student's current PIN
- the number of times an invalid access has been attempted using the student's current PIN, since the last time a valid access was accomplished
- the date and time the student last made a valid access with their current PIN

Whenever the CAO or Registrar's Office resets the student's PIN, the User-ID of the employee initiating the

on-line transaction is logged. When the student calls InTouch and successfully enters his/her new (non-birth date) PIN, the system logs "STUDENT" as the person initiating the change. The reason for a PIN change is captured and designated by the following codes:

- "C" - an ASU employee reset the PIN
- "I" - the student established a new (non-birth date) PIN for the first time
- "T" - the student called InTouch and entered a new (non-birth date) PIN after their PIN had been reset by an employee

When this screen is accessed, the inquiry history tracking count is incremented. If the PIN is reset, the inquiry count is reduced by one and the PIN reset count is incremented. Therefore, there is only one count for a session with a student.

```
RGTT130F  TOUCH-TONE TELEPHONE SYSTEM (INTOUCH)   11/10/92
LTERMID: CV200010    PIN CHANGE HISTORY           13:07:18

TASK:RGTT01  ID:468-46-2005  USER OFFICE: REG (REG OR CAO)

NEW PIN REQUIRED NEXT TTS ACCESS: Y

ID NUMBER: 468-46-2005    LAST VALID ACCESS DATE: 08-25-92
NAME: SMITH, JOHN C       LAST VALID ACCESS TIME: 20:48:52
INVALID ACCESS COUNT: 1        VALID ACCESS COUNT: 1
==========================================================
                        MAINTENANCE

   USER      OFFICE        REASON        DATE       TIME
 --------    ------        ------     ---------    ------
  KAEMS       REG            C        09-03-92   08:23:35
 STUDENT                     I        08-25-92   20:45:04



ACTION:                                          PAGE:  0001
ENTER = NEXT STUDENT  PF1 = RESET PIN SCREEN   PF7 = BACK
  PF8 = FWD           PF9 = HELP     PF10 = PREVIOUS MENU
 PF11 = MAIN MENU    PF12 = QUIT
```

Figure 2. PIN change history screen

Summary history of PIN transactions is available on-line and on monthly reports. Figure 3 is an example PIN TRANSACTIONS BY DEPARTMENT report. The reporting period is the five most recent weeks. The total activity of those five weeks, the current month and the previous month are also reported. Inquires and resets are displayed separately for the Registrar's Office and CAO, and displayed as a combined office count. All information is reported real-time. This means whenever this screen is accessed or the report generated, the system calculates the reporting period based on the current date. Inquiry and reset counts in the SIS, at the time, are reported.

CONCLUSION

For added security to your Voice Response System applications, use Personal Identification Numbers along with student identification numbers or social security numbers. Administering and managing the PINs can be quick and easy if you set-up an on-line system to assist your staff in handling various questions and problems that may arise.

There have been no security problems with ASU's approach of initially setting each student's PIN to their birth date. We recommend not tying the PIN to any other process or requirement such as issuing the student's PIN when they complete advisement. When the advisement rules/process change, it can have a negative affect on your PIN process. Keep the PIN process simple, safe and convenient! Your institution's staff, faulty and students will be very grateful!

RH0310-01 DATE 11/02/92 TIME 21.14.33

A R I Z O N A S T A T E U N I V E R S I T Y

TOUCH-TONE TELEPHONE SYSTEM (INTOUCH)

PIN TRANSACTIONS BY DEPARTMENT

WEEK		REGISTRAR'S OFFICE			COMPUTER ACCOUNTS' OFFICE			BOTH OFFICES		
STARTING	ENDING	INQUIRY COUNT	RESET COUNT	TOTAL	INQUIRY COUNT	RESET COUNT	TOTAL	INQUIRY COUNT	RESET COUNT	TOTAL
10-26-92	11-01-92	7	9	16	2	0	2	9	9	18
10-19-92	10-25-92	4	2	6	0	0	0	4	2	6
10-12-92	10-18-92	1	0	1	0	0	0	1	0	1
10-05-92	10-11-92	2	1	3	0	0	0	2	1	3
09-28-92	10-04-92	1	0	1	0	0	0	1	0	1
TOTAL OF WEEKS		15	12	27	2	0	2	17	12	29
TOTAL FOR OCTOBER		14	12	26	2	0	2	16	12	28
TOTAL FOR SEPTEMBER		41	36	77	2	4	6	43	40	83

Figure 3. PIN transactions by department report

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INFORMATION TECHNOLOGY: The Revolution Continues

STUDENT INFORMATION SYSTEMS

W1-2

Finding a Better Way: Implementing the Exchange of Electronic Transcripts

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Ricks College

Jerald D. Bracken
Brigham Young University

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Finding a Better Way: Implementing the Exchange of Electronic Transcripts

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In the fall of 1991, Ricks College and Brigham Young University (BYU) began discussing the exchange of electronic transcripts. In this paper we will describe the implementation of the AACRAO supported format for exchanging transcripts. We will also discuss the costs and benefits of electronic transcripts, as well as the major issues and problems we encountered.

The Problems with Paper Transcripts

Paper transcripts create a number of problems. Your experiences with them may be similar to ours.

Timing, The View From Ricks College

Ricks College, as the kid sister to Brigham Young University, sends between 1800 and 2000 transcripts to BYU each year. In the past, this procedure was very frustrating. That frustration intensified during the summer months as students attempted to meet the transfer admission deadline.

The biggest problem occurred primarily when the applicant's official transcript from Ricks College arrived at BYU before the application did. BYU data entry clerks did not know which semester the student was applying for, so they placed the transcript in a holding file to wait for the application. In addition to this missing information, BYU did not want to incur the cost of data entering a transcript for someone who was not going to apply. After the application was received, the transcript was not always retrieved from the holding file and attached to the application for data entry. The result was the student was sent a letter stating that the transcript had not been received from Ricks College. The transcript clerk at Ricks would then receive an unfriendly call from the student (or the student's parent) wanting to know why the transcript had

not been mailed to BYU. The problem would only be resolved after the Registrar called the Admissions Office at BYU and asked that they look again in the holding file for the hard copy transcript. Invariably, the missing transcript would eventually be found. But, to reach closure, three or four long distance phone calls were necessary. The Registrar at Ricks spent hours each summer defending procedures, office efficiency, and resolving these problems.

Lost and Misplaced Transcripts

When things get hectic, especially around application deadlines, it is surprisingly easy to misfile, misplace, or lose a transcript.

Labor Intensive Data Entry

Data entry of transcripts is expensive. At BYU, we figure that a data entry clerk can enter about 70 transcripts a day. That works out to be about eight an hour. We receive approxiamtely 20,000 transcripts each year. That represents about 2,500 hours of data entry time.

Data Entry Errors

Because data entry is so labor intensive, errors occur. At BYU, we estimated that a good data entry clerk will make a keying error on only 2 percent of the lines entered. However, because of the line item structure of transcripts, error rates become more of a problem. Using the 2 percent error rate on a 15 class transcript, for example, the chances of that transcript having some form of keying error rises to 26%. Each keying error may or may not be significant. To catch and correct these errors, as well as to extend a courtesy to the applicant, we send an advisement report showing how the transferred work contributes to a degree at BYU. If the student discovers an error on this report, we get a call, the hard copy transcript is pulled from the student's file, and the correction is made. Errors, even small ones, cost money.

Printing, Handling, and Mailing

As part of a pilot project, Information Associates (now part of SCT, Inc.) estimated that the printing and handling of a transcript cost about $5.00. This agrees with our experience as well. That means it costs Ricks College $10,000 to send BYU those 2,000 transcripts annually. That is a significant amount of change.

Problems of Delayed Data Entry

Transcripts do not come in evenly throughout the year. Transcripts bunch up dramatically around deadlines. The result is that at times BYU could be several weeks (or more) behind in entering transcripts. This causes several problems. First, the student does not know what is happening. So, the student begins a series of telephone calls, mostly long distance, trying to determine what the delay might be. A search is made for the student's file. This increases the work load on the Admission Office staff at a critical time. When the transcript is found, it is pulled out of the normal flow of operations, which creates the second problem. Whenever a transcript is dealt with outside normal procedures, the chances of that file being misplaced or lost increases significantly. The final problem is this. Does the transcript in question get expedited or does it go to the bottom of the stack? More often than not, it went to the bottom of the stack, further delaying its input.

Obviously, with these problems we needed a better way.

A Better Way

As early as four or five years ago, Ricks and BYU began talking about the possibility of transmitting official transcripts electronically. One approach was tried with mixed results. Ricks would send a tape once a semester with a variable length record for each student. BYU would then try to produce an advisement report from this tape. This procedure had a number of weaknesses. The result was that we were all nervous about a "proprietary" solution. We just had to wait for the standards and technology to catch up with our desires.

In November 1991, representatives from the BYU Admissions Office and computer staff went to Ricks to discuss the new AACRAO format for exchanging transcripts. That standard was in the process of being approved by ANSI, and it appeared that it would provide the means to finally address electronic transcripts. We hammered out many issues related to the timing of transmissions, transmission platforms, translation software, data elements, etc. We will discuss some of these issues in more detail later in this paper.

Our main goals were, first, to speed up the transmission of transcripts. That would relieve student anxiety. And in doing that, we would reduce the number of problem phone calls which were putting an unnecessary burden on our offices at critical times. The second goal was to avoid lost, misfiled, and unmatched holding file transcripts. The third was to reduce data entry errors. The reduction of handling costs was only a minor consideration for us.

The first transmission was sent in June 1992. The summer of 1992 was wonderfully quiet in the Ricks Registrar's Office. No angry calls from BYU applicants.

Procedures

The procedures for handling EDI (Electronic Data Interchange) transcripts are very simple. On the Ricks end this involves the following activities:

1. A student comes to the transcript window and fills out a written request for an official transcript to be sent to BYU.

2. The transcript clerk keys in the student's ID number and a screen appears, asking if the student wants the transcript to be sent electronically or wants a hard copy printed. (At the present time, Ricks is doing EDI transcripts only with BYU. However, Ricks is planning to expand this service as soon as the other schools get the technology in place.)

3. Each Monday morning, the Registrar selects a menu item which extracts all transcript requests going to BYU keyed in since the last transmission. When that program completes, the Registrar gets a report of all transcripts included in the extract. The extracted file is then sent to a PC to be translated by Supply Tech's EDI translation software to the AACRAO approved format and transmitted to BYU. Figure 1 in the Appendix shows how this communication process works.

Once the transmission has been received at BYU, Supply Tech's software package translates the AACRAO format to the format used at BYU. Figure 2 in the Appendix shows the steps involved in running Supply Tech's EDI translation software.

The translated file is then sent to the mainframe and a program is run to update the student's records. The update program produces a list of all students in that transmission and a list of transcripts that still require the intervention of a terminal operator or evaluator. There are two types of problems which require intervention. The first occurs when a class has no matching evaluation record. This means there is not enough information to evaluate that class automatically. An evaluator examines the class, decides how to evaluate it, updates the student's records, and adds the evaluation information to the Evaluation File. This allows the class to be automatically evaluated the next time it appears on a transcript.

The second problem occurs when the student can not be positively identified. For example, when Ricks sends BYU a transcript for a student who does not have a social security number, Ricks uses their local identification number. Therefore at BYU, we have no way to match up the transcript with a student at BYU. Another example occurs when last names do not match. Is the transcript really being sent for the same person? More often than not, the problem is nothing more than a name change resulting from a marriage. But, which name is the right one? In both these examples, a terminal operator must intervene before the transcript updates the student's records. We handle this by writing these transcripts to a Suspense File. The operator looks at the Suspense File, resolves the problem, and then re-applies the transcript to the student's records. Figure 3 in the Appendix shows the Suspense File process.

Issues and Problems Encountered

During the design phase of this project, we wrestled with a number of issues and problems.

Learning Curve

The world of electronic documents introduced us to a whole new set of vocabulary and concepts. Electronic Data Interchange (EDI) refers to a set of standards for electronically transmitting documents. The AACRAO transcript format was also an ANSI (American National Standards Institute) approved EDI document, subject to the same rules and conventions as other EDI documents. Concepts such as transaction sets, segments, elements, etc. had to be digested.

In addition to this, we found we had to build or bring together knowledge and expertise from a number of diverse areas:

1. Networking -- Internet, communication protocols (TCP/IP, etc.), Value Added Networks (VAN's), etc.

2. Local Area Networks (LAN's).

3. PC's.

4. Mainframe communications.

5. Student records application software, data base design, interfaces, etc.

6. EDI translation software packages.

Choosing a Communication Platform

One of the first decisions we had to make was which communication platform we were going to use. We identified four reasonable alternatives:

1. A direct connection over a phone line between Ricks and BYU, i.e. modem to modem.

2. A tape or diskette exchange through the mails, i.e. a sneaker net.

3. A Value Added Network (VAN), i.e. a commercial network like IBM's, G.E.'s, British Telcom, etc.

4. The Internet.

We chose to use the Internet for the following reasons:

1. Most colleges and universities already have Internet access.

2. Internet access represents a fixed cost to these institutions that has already been covered. This means the marginal cost of using the Internet for EDI transcripts is near zero. On the other hand consider the cost of a Value Added Network. A VAN typically charges 50 cents per 1,000 characters transmitted. The average EDI transcript from Ricks consists of 1,500 characters. An average batch of 70 transcripts,then, would cost $105. It would be cheaper to put the transcripts on a diskette and express mail it.

3. The Internet is very fast. 1.5 million bits per second and 51,000 bits per second are common transmission speeds, with some links as high as 45 million bits per second. Even a large batch of 1,000 transcripts could be transmitted in seconds as opposed to hours using a modem connected to a VAN.

4. The Internet is very reliable.

5. The Internet is quite secure. Unlike the old BITNET, which was a "store and forward" network, Internet is a "packet switched" network using physically secured routers instead of users' computers to forward transmissions. It would be very difficult to intercept, modify, or create a bogus transcript transmission on the Internet without its being detected.

Buy or Build

The next most important decision was whether to write the translation software ourselves or to buy an EDI translation software package. After reviewing the EDI transcript standards and rules, we concluded that coding the communication handling, translating, cross reference tables, etc. was possible, but not easy. Also, the maintenance cost of such complex code would be high. But most important, what would we do as we added more and more EDI documents. The Purchasing Office at BYU had also expressed interest in using EDI technology. Why should they have to re-invent the wheel? For us purchasing EDI translation software was the best choice. We chose STX from Supply Tech, Inc. for the following reasons:

1. They were willing to develop and support an Internet capability.

2. They were experienced and had a large customer base.

3. They supported many different communication platforms, i.e. all VAN's, direct connections, tape and diskette exchange, as well as Internet. We could use the same software package regardless of the communication platforms we negotiated with other trading partners or EDI documents.

4. They were one of the few EDI software vendors which supported the EDI transcript transaction sets at the time.

Design Decisions

We also struggled through some important design issues. First, should we do a class-for-class update of a student's transcript work? Or, would it be more appropriate to delete the old transcript and replace it with the new one. The decision rested on our ability to automatically re-evaluate the student's transcript and get the same answer. We were confident that our automatic evaluation could re-evaluate the transcript with few errors or little need for operator intervention. This decision made the update program much simpler. It would assume that the new transcript was complete and accurate. So, it did not have to check for repeats, grade changes, missing classes, etc.

Second, although the EDI transcript had a standard format, we examined every data item in that standard to make sure we all interpreted the data values the same. Some of these required a little negotiation. For example, there is room for a student's address to be sent. Which address should that be, mailing address, or home address. Just exactly what does each grade mean? The A's, B's, C's are obvious. But, what about pass-fail, credit by exam, withdrawals, grades not submitted, repeats, etc.?

Third, we found one important piece of information missing from the EDI transcript. Often the transcript is the first document received in the admission application process. It would be very helpful if the EDI transcript indicated whether the transcript was being sent as part of an application, and if so, indicate which year and term the student was applying for. We decided this was important enough in the relationship between BYU and Ricks that this information would be coded in a note segment. Even though this feature was not recommended by the AACRAO committee which developed the standard, we felt the benefits outweighed the risks.

Was It Worth the Effort

We were confident this technology would be a benefit to both BYU and Ricks in many ways. We were correct -- and it is even better than we anticipated. Not one angry student called this past summer. Table 1 shows the cost Ricks and BYU incurred as of this writing. Table 2 shows the cost savings we realized.

Table 1
Cost of EDI Transcripts

Up Front Cost:	
$5,000	2 copies Supply Tech's STX package
7 person months	Analysis, design, learning curve, programming, software selection, training, negotiation, etc.
On Going Costs:	
$1,200 per year	Software maintenance

Table 2
Cost Savings of EDI Transcripts
1,000 Transcripts Received to date

$290	Postage
$5,000	Handling ($5 per transcript, SCT, Inc.)
$1,200	Data Entry (15 person days)
$6,490	Total savings
$18,000	Projected Savings per year

These tables show that moving to an EDI transcript has clearly been worth the effort.

In addition, the speed of getting the transcript from Ricks to BYU with no lost or misplaced transcripts has greatly reduced the hidden costs of dealing with hard copy transcripts.

As a result of these benefits, the President's Staff at Ricks College approved a proposal to cancel the transcript fee for any transcript sent via EDI effective January, 1993.

Future Plans

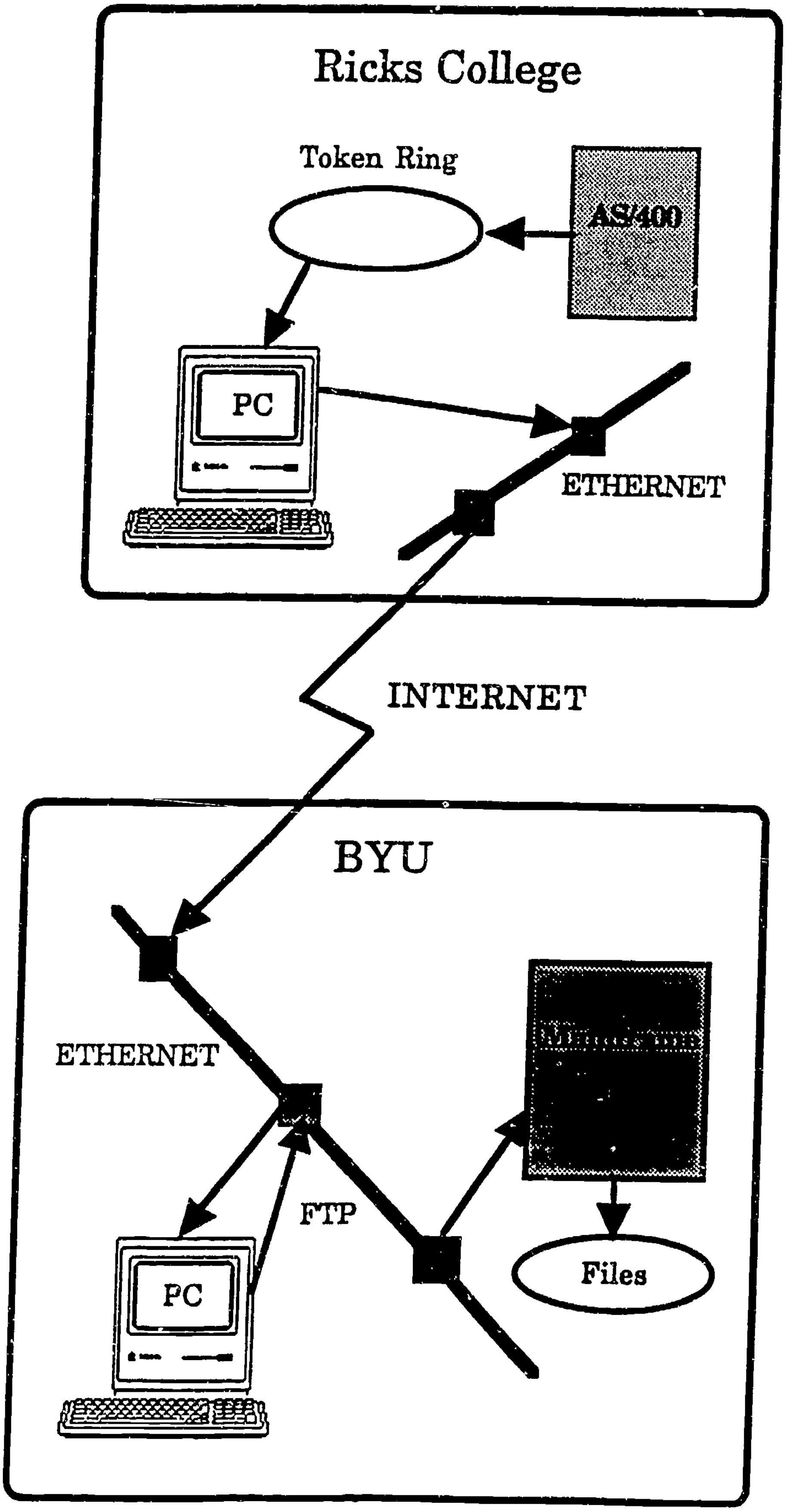
We plan to expand the EDI concept in the following ways:

1. Transmitting transcripts from BYU to Ricks.

2. Exchanging EDI transcripts with other colleges and universities.

3. Incorporating additional EDI documents, for example, admission applications, financial aid transcripts, verification of enrollment, etc.

APPENDIX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AS/400
PC
ETHERNET
INTERNET
BYU
ETHERNET
FTP
PC
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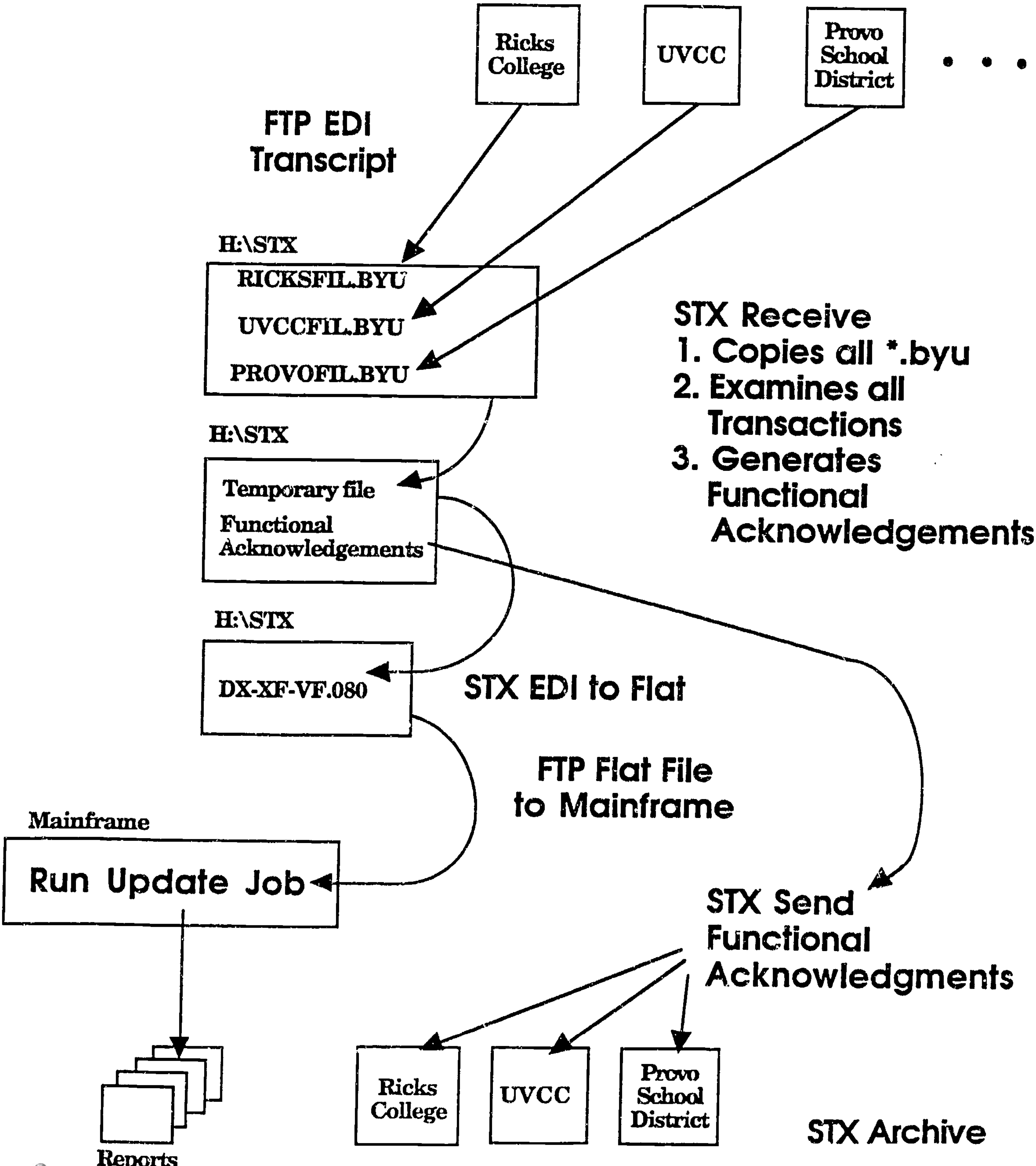
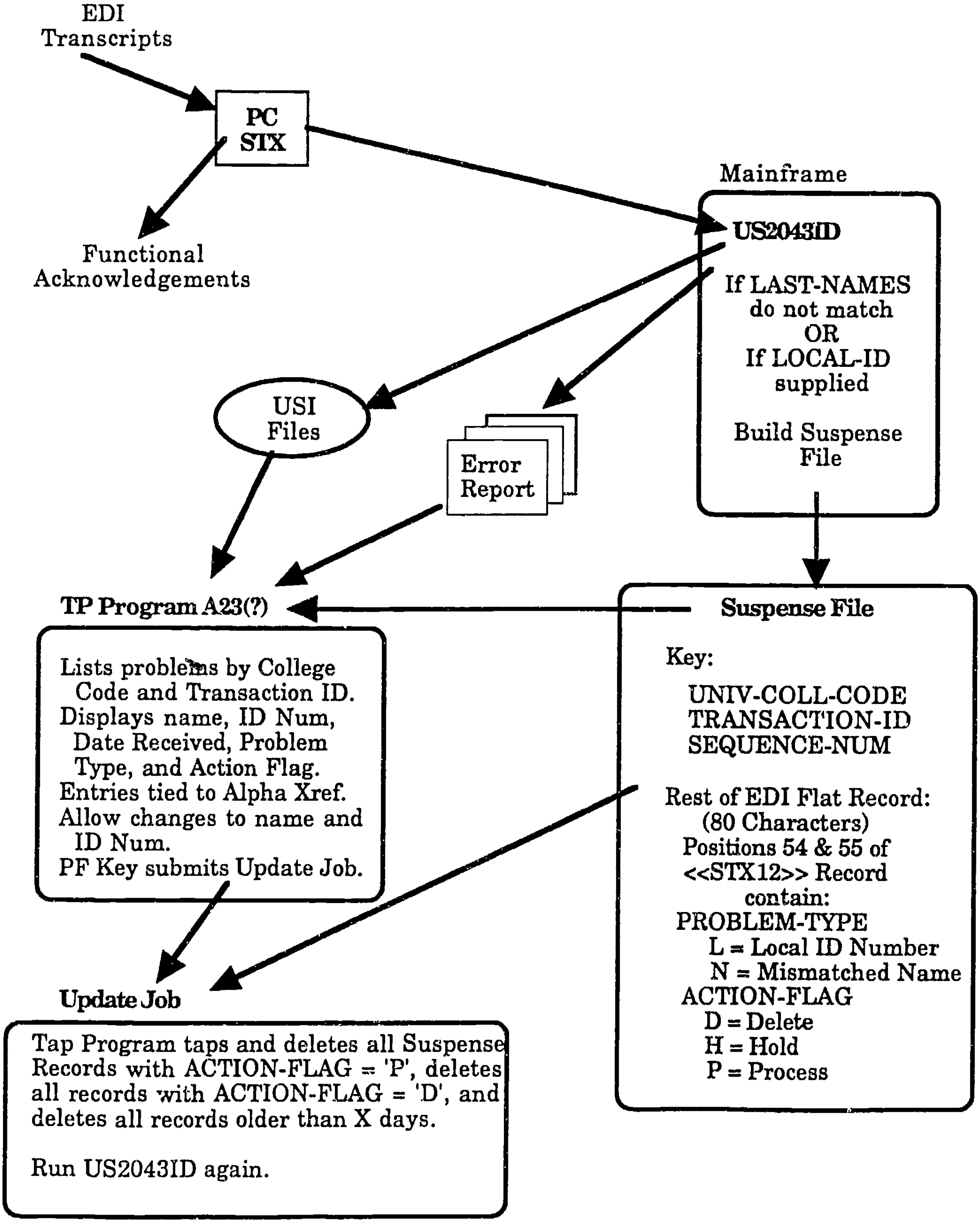
STX Description



Suspense File Concept
September 3, 1992



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Moving Toward a Paperless Workplace at the University of Michigan

Karen Dickinson
Patrick McCormick
University of Michigan

38th Annual
College and University
Computer Users Conference

Hosted by Baylor University
in San Antonio

May 9–12, 1993

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Moving Toward a Paperless Workplace at The University of Michigan

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"Sixty-five cents of every dollar spent on record-keeping is wasted on unnecessary files and duplicate copies," said Dianna Booher, in an article entitled, "Cutting Paperwork in the Corporate Culture" (*Facts on File*, 1986).

"By bringing design and production of forms in-house, companies can save more than 70%.... The drive to get electronic forms off of large systems and onto personal computer platforms may shrink costs even more. But saving money isn't the real benefit of forms automation. Through the use of workgroup automation and client/server, enterprise-wide connectivity, firms are improving the quality and efficiency of their operations because users get a palatable interface to enterprise data. " said Michael Bragen, in an article entitled "Form Fitting" (*Computerworld*, September, 1992).

Introduction

Replacing paper documents with the capability to prepare and process documents electronically at the desktop workstation has long been a high priority issue at The University of Michigan (U-M). Progress toward a paperless workplace has been slow, because of the many surrounding issues including legal implications, a highly heterogeneous computing environment, and the amount of resources involved. An Electronic Documents (EDOCS) group was formed this spring to determine the best way to build on earlier efforts, to provide direction for various ongoing campus initiatives, and to develop a plan for the most effective and efficient processing of business transactions for the University community. This report defines the first phase of the migration to a paperless workplace at U-M and includes a blueprint for future phases.

*The other EDOCS Subgroup members: John Gohsman (Chair), Chuck Hawkins, Jim Peters, and Dick Albertson.

Background

U-M's decentralized and heterogeneous nature increases the magnitude and complexity of the security, political, and technical issues. U-M is a classic "multiversity". It has seventeen schools and colleges on the Ann Arbor campus and two regional campuses in Dearborn and Flint. Although one Board of Regents and one President oversees all, each department has its own policies and standards. On the Ann Arbor Campus, some functions are performed centrally, such as registration and student accounting; others, including admissions and financial aid activities, are performed both centrally and by departments. Still others are done solely by departments, including academic advising and certification of degree requirements.

Computing is already quite distributed, with an estimated 20,000 personal computers being used in offices, campus computing sites, residence halls, and in remote locations. Many staff and students perform their work from varied locations, including dialing in from home Throughout the campus, thousands of computers linked to state-of-the-art networks provide faculty, staff and students with resources that can maximize creating, using, and sharing information. Many of the larger departments, such as the College of Engineering and Business and Finance, are at the forefront of rapid advances in information technology; other departments are on a computer hardware replacement cycle of seven or more years.

Many departments also share information and send mail on local area networks (LANs), with Banyan and Novell being major campus presences. Other departments are operating primarily in standalone mode or connecting to one of three mainframe hosts on the Ann Arbor campus. There are multiple mail systems; these include a homegrown mainframe mail system (MTS $Message), Microsoft Mail, Lotus CC:Mail, and various UNIX mail packages in the public domain. All this is consistent with U-M's philosophy that diversity should be encouraged on all levels and that departments should be able to control their own destinies. However, this philosophy compounds the problems of migrating to electronic documents.

To add to the complexity, the computer environment at U-M, as in the country at large, is in a period of transition from centralized, mainframe-based computing to fully decentralized computing. We are moving toward an environment that is centralized from the user's viewpoint, focused on the workstation, and tailored to specific user needs. A key U-M goal for migration to electronic documents is a smooth, phased transition of users from host-based e-mail systems to fully distributed e-mail within three years, since e-mail will be the transport for routing electronic documents.

The potential for tremendous savings has sparked several significant efforts to migrate toward electronic documents despite the barriers.

- The Electronic Document Handling System (EDHS), designed at U-M in the late '80s, defined many of the benefits of and requirements for an electronic business transaction environment. Three successful electronic document systems were implemented as IMS transactions in the 1980s. The University Stores Requisition System was implemented as a prototype in 1984. This system was the springboard for designing a more comprehensive electronic documents system. Users and developers were enthusiastic about the potential for electronic documents, but needed a quicker method to develop them. The EDHS project produced a Project Definition and a General Systems Design. Two other documents, the Food Stores Requisition and the Purchase Requisition, were developed and implemented under the EDHS umbrella. The effort was finally tabled, since a mainframe solution didn't appear to be cost-effective.

- Uniform File Formats (UFF): in response to user requests, Financial Operations has invested significant resources in exploring uniform file formats to introduce nine statement of account transactions into central administrative systems in a standardized way. Some users created forms using local software, such as Excel and dBASE, and wanted to have these entered electronically into the system instead of printed on forms for subsequent keypunching. Two forms, cash receipts and journal entries, were followed to their final format in application programs. The analysis showed that most business transactions were in the same electronic format despite the fact that the paper forms were different. The UFF project has already saved approximately two weeks of manual processing each month. The project has also spawned projects for other transactions, such as producing service unit billings and downloading credit card information and lock box information from online bank systems. Once information is put into standard, electronic media, it will be easier to adapt to the ever-changing technical environment.

- The External Electronic Data Interchange (EDI) Project: U-M is improving its Purchasing and Accounts Payable system to better handle the annual volume of 130,000 purchase orders and 430,000 invoices. Purchase order files will be downloaded daily from the mainframe to an EDI server, then transmitted over the Internet network to a value-added network (VAN). The VAN has "mailboxes" on a computer system provided by a third party vendor. EDI transmissions of invoices, acknowledgments, and responses to request for quotations will also be available over the Internet and uploaded to the mainframe.

- The College of Engineering's Computer Assisted Engineering Network (CAEN) developed a Claris FileMaker system that facilitated electronic filling of about fifty common U-M forms for Macintosh users. This system was developed by CAEN primarily for Engineering's own use and some maintenance difficulties resulted surrounding obsolete versions of forms, since form owners weren't directly involved. CAEN offered to share the system with other U-M departments and about 50 departments now subscribe. DOS users wanted a similar system, and a DOS Electronic Forms pilot was undertaken. This pilot team is a partnership of twenty-five U-M departments, including forms owners and the Information Technology Division (ITD).

The DOS Electronic Forms Pilot

The DOS Electronic Forms pilot was intended to reduce the amount of effort in producing common U-M printed forms by enabling them to be entered online via microcomputer. Other important goals of the pilot were to provide information needed to resolve some of the issues surrounding elimination of paper forms, including the amount of support required, without diverting extensive resources from the larger task of eliminating paper forms.

There is general agreement that the real benefit will come from re-engineering processes and optimizing electronic transmission of forms--moving beyond the paper model and redundant processes. Eliminating paper forms was beyond the scope of the pilot, since important issues, such as authentication and security, need to be resolved before printing can be eliminated.

Benefits of the pilot included:

Saving time:
- Errors easily corrected and caught earlier.
- Repetitive information extracted from previous or related forms or departmental databases to fill in new forms.
- More accurate information due to automatic calculation of fields, edit capabilities (including required fields), possible field validation.
- Faster information retrieval--existing records and departmental databases could be queried.
- Reduced or eliminated the need to order forms.
- Facilitated easy distribution of forms.
- Eliminated bottlenecks that caused key deadlines to be missed.

Saving paper:
- Eliminated need to stock blank forms (especially cost-effective with expensive multi-part forms).
- Eliminated storing hard copy of forms (if office procedures permit).
- Eliminated obsolete/unusable forms.

Better record keeping:
- Data files produced from the forms package were used to do office accounts.
- Standardization and improved quality of the process.

The pilot provided a subset of forms to DOS users in PerForm Pro by Delrina Technology. PerForm Pro was selected since it was highly rated in the trade journals, met all the important criteria defined by a U-M Forms Evaluation Team, it interfaced with dBASE files, a rigorous pilot could be conducted at a reasonable cost, and the software was affordable. Collaboration with forms owners was viewed as critical; all forms were reviewed by the office that owned the forms for accuracy before distribution.

Pilot Results

Filling forms with the Windows and DOS GEM product worked well (the DOS GEM version has a graphical interface that looks to the filler like the Windows filler version). However, pilot participants needed a 386 machine or higher for acceptable response time which would be expected for an application of PerForm's power and complexity. However, the participants that were interested in using the GEM product had lower-end machines and found the slow response time a barrier to using the product. Results reported by forms fillers include:

- Using the filler software cuts forms filling approximately in half (which could be one or two hours a day for typical administrative staff).

- Printing requires 1 megabyte of RAM, more than a typical secretary's configuration, and getting printers configured correctly was tricky.

- WYSIWIG (actual representation of the form on the screen for filling) may detract from the process if forms are difficult to read. Using a different form for data entry may make sense and text-based forms may be acceptable if the functionality exists.

- There were some printing problems that the new version of PerForm Pro 2.0 for Windows has fixed.

Delrina's PerForm Designer and Tracer products for designing and converting forms into electronic format also worked well for people familiar with Windows. PerForm Designer's wide range of features and options facilitate forms design, including spreadsheet capabilities, drawing tools, and the ability to read and update dBASE files and graphics. PerForm Tracer accepts a scanned image, aligns lines and boxes, and interprets some relationships between fields defined by lines, such as fields to be summed. Results reported by designers include:

- Since the application has many features and options, the learning curve for Designer is high and wouldn't be justified for most offices. Several forms owners said they would rather hire ITD to do the basic forms design, although they did want to make minor changes to their forms. The Department for Research Development Administration (DRDA) has very complex forms that change frequently, and they may develop in-house expertise once a decision is made about supporting the forms software.

- Using Tracer cuts designer time about 1-1/2 hours (more on forms that have mostly lines/boxes; on forms that are mostly text, Tracer is less useful).

Both forms fillers and designers were asked to evaluate how well the proposed process meets U-M needs. Reported results include:

- Potential for Significant Savings. Most pilot filler participants who were familiar with Windows and had model 386 or higher machines (designers and fillers) found it worth the effort to convert to electronic forms. Automatic searching, storing and filling repeated of already stored fields significantly increases the speed and reliability of forms filling. The ability to read and write dBASE files and a programming language behind the process may make PerForm more attractive than other alternatives, such as FileMaker Pro 2.0 for Windows, but this needs to be verified. The ability to have edits and mandatory fields significantly increased the reliability of forms filling and saved time in redundant entry and resolving errors.

- Electronic Routing. Delrina's products have the ability to electronically send forms, and have security and authentication features. Even in the short term, it may be possible to do some electronic routing of forms, which is where true savings accrue. What needs to be tested is whether the products can be integrated into the U-M computing environment, with its dissimilar LANs and mail systems, and how much effort would be required.

- Support Concerns. Delrina's rapid growth resulted in changes in sales representatives and technical resources as territories were redefined during the pilot. This put a burden on some of our expert staff. Also, the education market is a new area for Delrina. Although several pilots are underway, they do not have a formal education program and this will make it harder to work with them. Recently, Delrina has shown more commitment to U-M. Also, we anticipate an environment where ITD creates a fairly limited number forms and supports users filling forms, so vendor support is less critical than if ITD were attempting to support forms creators and a large number of forms. However, we do have concerns about vendor support.

- Other Key Results. It is important that this project fit into related efforts at U-M. **It is critical to avoid the trap of simply automating the existing paper process if there is the potential for re-engineering the process.** This technology is moving very fast. Any decision is likely to be viable for only 1-2 years, so the investment must be recaptured within that timeframe (including training/retraining and other support costs).

Pilot Recommendations

The pilot demonstrated that the amount of efficiency that can be gained by targeting appropriate forms and users is significantly greater than the investment of converting the forms, acquiring the software, and training staff how to use electronic forms. However, problems with the product, particularly memory requirements and slow printing, along with reservations of key support personnel about the process suggested a cautious approach. Participants in the DOS Electronic Forms Pilot decided that they did not have enough information to make a recommendation to the U-M committee that determines which products will receive support and what services will be offered. Moreover, they thought that focusing on DOS/Windows alone was unwise. Therefore, pilot participants recommended:

- The Electronic Forms Evaluation Team should consider alternatives in both the Macintosh and DOS environments.

- The number of electronic forms (converted to the recommended software) and forms fillers should be gradually increased according to pre-defined criteria, so that the process is cost-effective and does not become unmanageable.

- The process should be viewed as an interim solution that will be continually evaluated and replaced by a more desirable solution. Although some of the investment will probably be salvaged, it is important to recapture the investment within a short timeframe (1-2 years).

The Electronic Documents (EDOCS) Project

In addition to the DOS Electronic Forms Pilot, there are a number of significant ongoing efforts at U-M related to electronic document handling. The Electronic Documents (EDOCS) group formed during the spring of '92 to define a common vision and to develop a plan to establish the most effective and efficient processing of business transactions for the U-M community.

The EDOCS group agreed that minimum requirements for electronic documents include routing a document through channels; signed by appropriate people, with validation, authorization, and authentication; and filed for quick retrieval for reference or inspection by auditors. The following project goals were identified:

- Build on the existing foundation of previous efforts and collectively reduce institutional costs.
- Meet valid customer needs as long as a need is reasonable, achievable, legal, and ethical.
- Provide a flexible system that can adapt to future needs and changes.
- Provide the flexibility to use whatever terminal/software combinations users have to create and transmit electronic documents to other addresses on the network
- Create an overall vision and strategy to provide a consistent and standard environment for the user community
- Ensure that all projects related to migration toward electronic documents work to implement this vision do not perform redundant development efforts.

Environment for Electronic Documents

The computing environment for electronic documents has already been well defined by other U-M groups charged with defining the vision for a future computing environment. The EDOCS Group supports their vision and notes the following points as particularly relevant for electronic documents:

- The environment will be distributed. Computing, instead of being concentrated on a mainframe computer, will give computer users desktop access to a broad range of computing and information system technologies, which could include mainframes.
- Client-server software, rather than terminals, will be increasingly used to manipulate, view, and modify data. This will allow users to take advantage of the computational power available from desktop machines.
- Certain services, such as mail and paperless documents, will still be handled centrally (e.g., forms will be stored in a central repository).
- E-mail running on a reliable, high-speed, high-capacity Campus Backbone Network with support in place, will provide the transport.

- The environment must be secure, with authentication, auditability, and controls in place.

- Commercially available software should be used as much as possible as well as University-enhanced software.

- Evolving standards should be adopted, such as X.400, Multi-purpose Internet Mail Extension (MIME), Apple's Open Collaboration Environment (OCE), Microsoft's Messaging API (MAPI), and Vendor Independent Messaging (VIM).

The EDOCS Group also supports the principles of Electronic Data Interchange (EDI). For many years, EDI has been providing companies with a method to exchange information electronically, from disparate systems. This low technology solution has provided many benefits to these companies, including quicker response, higher quality service, lower costs, and better information. Transactions typically exchanged between companies include purchase orders, invoices, and payments. Some universities are starting to use EDI to exchange transcript information. The EDOCS Subgroup has researched EDI technology and believes the same concepts, principles, and possibly the software itself, could be applied to the electronic document needs of U-M. In addition to the above environmental characteristics, EDI requires:

- Trading Partner Agreements. A contract is made between two groups that want to conduct business electronically, agreeing to establish appropriate controls, standards and testing to ensure that the electronic information is correct, auditable, and approved.

- Standards for each Transaction Type. Transaction types such as purchase requisitions, journal entries etc. will have the same fields in the same format and sequence and be consistent with the American National Standards Institute X.12 uniform standards for electronic interchange of business transactions

- Translation software. Translation software provides a method to map, or translate, data from an application into the standard format and to take the standard format and map it back to an application.

The Planning Process

Effective planning is essential for an undertaking of this magnitude. Although there is tremendous potential for reducing effort, the inevitable change in customary, critical routines will also be disruptive. A coordinated, phased effort with active participation by affected parties will ameliorate the negative aspects of change. Fortunately, the climate for planned, gradual change is very favorable at U-M and there are several key methodologies in place to assist in the transition.

Efforts to Improve Quality at U-M

M-Quality is a U-M priority initiative now underway to examine and better understand its administrative and business processes. The Information Technology Division (ITD) has been independently engaged in a Total Quality Management (TQM) initiative for the past two years; TQM provides methodologies for improving processes and sets the overall "Plan, Do, Check, Act" cycle for everything ITD does.

A brief summary from the M-Quality report, an initial planning document, states that the M-Quality approach will encourage positive change within U-M. Four key principles are the foundation for M-Quality:

- Pursuing continuous improvement: studying administrative and business processes, making trial improvements and testing them, and revising them based upon further evaluation. The M-Quality approach is expected to evolve over time as U-M gains experience with it.
- Managing by fact: making a distinct effort to gather and analyze relevant facts as a guide to decision making.
- Respecting people and ideas: based on the assumption that the majority of difficulties in the workplace are caused by problems in the systems rather than the people who operate within these systems.
- Satisfying those we serve: focusing on the recipients of the work.

The report points to a three-part focus on leadership, teams, and individuals:

- Planning for excellence: a set of leadership activities intended to clarify, reaffirm and communicate the mission and vision of the University and to bring policies and procedures into line with M-Quality principles.
- Quality-improvement teams: designed to study and improve work processes. The EDOCs project is an example of an informal quality-improvement team.
- Quality in daily activities: draws more fully on the potential of everyone within the organization by empowering individuals to use information to implement appropriate changes in how they do their work.

ITD Planning Methodologies

ITD has several planning methodologies in place that facilitate designing and implementing successful information technology systems: the ITD Planning Model, the ITD/University Information Systems (UIS) Systems Development Methodology, and the UIS Strategic Data Planning (SDP) process. Although developed independently, they share many of the same principles and also complement each other.

- The Planning Model facilitates formulation of a project plan for addressing the need, developing and implementing the solution, and supporting and evaluating the results. Following the Planning Model contributes to ownership by the appropriate parts of the Division and ongoing commitment to the solution by adopting a cross-ITD, "whole system" perspective. It outlines steps and guidelines to pull together the right people to address the specified customer need, and further aids in producing the initial scope and charge for a system development project.

- The SDM comes into play once the right people are gathered and charged appropriately to address the need. The SDM provides guidance in the pre-development stages, as the charge and scope of the project is further defined, and it also provides guidance in defining specific customer requirements and further definition for the solution.

- Strategic Data Planning is a collaborative effort between ITD, Business and Finance and Academic Affairs. Strategic Data Planing is the establishment of a long term direction for the effective use of information resources. The U-M approach is based on James Martin's Information Strategic Planning. It will result in the creation of an institutional data architecture and an information systems plan.

Other Factors Contributing to a Successful Migration

Several factors for a successful migration to electronic documents emerged in a review of the literature and are consistent with U-M experience, U-M and ITD strategic directions, and the methodologies described above.

- Analyze work flow to identify processes that need rethinking. The best kinds of forms systems are based on careful collaboration by information systems groups and key users to find out how many documents are in use and how those documents support tasks.

- Use the e-mail infrastructure to cut duplicated effort. An existing mail system already resolves such issues as user addressing, message storage and routing, multiple client interfaces, gateways between dissimilar environments, and security.

- Maintain a centralized repository of important documents to ensure that electronic document exchange functions smoothly and accurately.

- Implement electronic documents in small pilot projects, then tie them together; meanwhile, design solutions from the top down for a cohesive, long-term strategy.

- Provide a corporate model that promotes data consistency and standardization and minimizes duplication in capturing, storing, and maintaining data.

Project Recommendations

A pilot project was proposed to last approximately one year. Pilot goals are to evaluate alternatives for electronic transmission (including routing), authentication, authorization and distribution; discover the level of coordination and facilitation that an electronic documents environment requires; and plan for the future. Concurrently, documents can be categorized by security level and volume. A proactive approach is strongly recommended for resolving security issues for more sensitive documents. Pilot results will provide information to aid in the creation of a long-term strategic and tactical plan for migrating toward electronic documents, including setting priorities for re-engineering processes.

Following is a description of the three recommended alternatives for testing:

Transmission/Routing/Distribution

- Internal Electronic Data Interchange (EDI) (Supply Tech).
  Test the feasibility of using electronic data interchange (EDI) software and methods to exchange information electronically across disparate U-M systems. EDI has been widely used to transfer information between organizations, such as banks, but the same approach may be successful within departments of a heterogeneous organization, such as U-M.

- Mail-enabled applications (e.g., CC:Mail, Microsoft Mail).
  Test the feasibility of using a mail application to send documents entered and edited with PerForm or FileMaker Pro for Windows. Tracking of documents status would not be included, and there may be limitations on security features (authentication and encryption), particularly when documents travel between different mail systems, such as Microsoft Mail and CC:Mail.

- Group Communications Software (Lotus Notes)
  Test the feasibility of using Lotus Notes to enter, edit, encrypt, send or route to a pre-defined list, authenticate, approve if necessary, and track documents online. Lotus Notes has a limited forms creating capability and an imaging capability so that attachments, such as a memo, can accompany a document electronically.

Several documents have been suggested to test different aspects of the approaches. All processes are internal to the U-M, so under U-M's control.

- Purchase requisition: used to place an order at U-M stores. The processes are fully defined and the form is a simple one. No cash is involved in the transaction.

- Journal entry form: used to transfer dollars between accounts. It is a cash transaction, but since it is an internal U-M process the risk is less than if cash could leave U-M. The processes have been fully defined and the form is a simple one. Attachments may be required, such as receipts.

- Course approval request form: describes a proposed new course or change to an existing course. It is an internal U-M document, the processes have been partially defined and plans are underway for fuller definition. Electronic routing would make a significant difference (it is an 6-part document).

Financial Operations provided funding to evaluate the three methods on the journal entry form.

Emerging Themes

Several themes have emerged from the several projects currently underway:

- <u>Focus on the business rules and processes</u>, not on the technology. It's important to design an automated process so that new more optimal technical solutions can be substituted transparently from the user's perspective when they become available. For example, we see sending and routing information around for approval separate from updating the institutional data repository; the two processes will be integrated, but not combined.

- <u>Re-engineer any process before automating it</u>, taking advantage of the electronic medium and not being bound by the current paper design. It's important to realize that many processes can't be fully automated; partial gains with large volume can still yield significant benefits. For example, many personnel forms with stringent security requirements will still be printed out, signed and routed in traditional ways, but the data entry and edit portion of the process can be automated.

- A single enterprise-wide solution appears unlikely in the foreseeable future. Offices vary in style, computing environment and technical sophistication. We prefer to select a few products that are industry leaders whose vendor's vision is consistent with the U-M strategic direction. It is also important that the vendor have the resources to implement the stated vision. We evaluate these products in the U-M environment, implement solutions using these products on a small scale, and offer the solutions as options to selected customers. For example, we agreed to try Lotus Notes on one form for one office: Financial Operations' journal entry form. Whether we offer it to other offices depends on Financial Operations' approval of the approach (as well as the approval of Internal Audit).

- Do minimal programming. Choosing vendor solutions that are fully developed and integrate smoothly into the environment, or those where the vendor is willing to work with us to integrate their products into our environment, frees us from excessive in-house development. For example, we will evaluate Delrina's FormFlow product, which is expected to be released this year and may facilitate forms routing and tracking, rather than write our own electronic "routing slip". If FormFlow cannot serve as an electronic routing slip in our environment, we will use Lotus Notes or some other vendor's technical solution even if it means delaying our routing plans.

- Partnership with users is critical. Partnership with forms designers/receivers ensures accuracy and integrity of the process and allows us to offload the maintenance burden in some cases. Partnership with forms fillers ensures that the product meets their needs and enables us to offload some of the support burden if offices have internal technical support resources.

- Cost-payback must be achieved within about one year. Some pieces of pilot systems may be retained, or the pilot may continue despite "better" technical solutions if an office decides the costs outweigh the benefits. Each office should make the decision assuming that the system is essentially disposable within about one year. This is an area that causes us some concern. Once an office and their clientele become accustomed to a way of doing business, they may be unwilling to abandon it even in their own "best" interests. We intend to be clear at the outset with our customers about cost and risks and to let them decide.

- Participation requires a fairly high-end computing environment; it is unrealistic to try to hit the lowest common denominator. Customers will need connectivity to the Campus Backbone and machines with sufficient power to run typical electronic forms applications (e.g., a Windows environment with a model 386 PC or higher with 4 megabytes of RAM and a recent model laser printer with sufficient memory to handle complex printing tasks). The U-M is committed to improving the computing infrastructure, but for the near future, our less affluent customers won't be able to fully participate in the benefits of these new technologies. Currently, we are working on solutions that work on Windows and Macintosh platforms. DOS products do not seem equal to the task, and there is not sufficient demand to invest resources in a UNIX solution.

- Keep the future in mind. It is critical not to lose sight of the fact that an important part of this effort is to lay the groundwork for the future, which is to provide full electronic routing and authentication. This will require identifying security requirements, agreeing on priorities for re-engineering business processes, planning an adequate infrastructure (technology, procedures, and support), and developing a strategic and tactical plan for migrating to electronic documents.

Summary

U-M is working with forms owners and forms fillers to create a strategic and tactical plan for a gradual migration toward electronic documents. Concurrently, a number of pilot projects are being undertaken that will reveal the most cost-effective approaches and determine the necessary technical and support infrastructure that must be in place. The anticipated environment is one where computing is distributed and focused on the desktop. This environment is expected to offer significant benefits of economy and flexibility, but there will also be challenges. By making an investment in strategic and tactical planning, selecting small pilot projects that will have maximum payback, and involving our customers from the outset, we hope to ensure a smooth, gradual migration to a paperless workplace. The vision is clear; at U-M we believe it is critical to begin taking the steps toward achieving that vision.

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INFORMATION TECHNOLOGY: The Revolution Continues

FINANCIAL & ADMINISTRATIVE SYSTEMS

M3-3

$SumMIT at MIT

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38th Annual
College and University
Computer Users Conference

Hosted by Baylor University
in San Antonio

May 9–12, 1993

$SumMIT at MIT

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Introduction

The Comptroller's Accounting Office (CAO) at MIT developed the $SumMIT client server financial reporting application to provide multiplatform user friendly access to MIT's financial database. $SumMIT's current users include vice presidents and other senior officers, as well as department level users. CAO expects that $SumMIT will eventually replace CAO's popular mainframe financial reporting application, developed about five years ago, with a user friendly desktop integrated reporting and data input system. This paper describes some of $SumMIT's current features and options.

Technical Background

The purpose of $SumMIT is to provide user friendly access to MIT's accounting data warehouse, which resides in a large relational SQL/DS database on an IBM mainframe. To accomplish this purpose, $SumMIT uses a client server architecture (the data tables reside on the mainframe, but the application runs on your workstation).

$SumMIT is fully integrated with your workstation and takes advantage of its features, such as windows, your mouse, pull down and pop up menus, color monitors, and spreadsheets and word processors. Reports from $SumMIT can be printed locally or exported for use with other workstation software.

The technical tools used to develop $SumMIT are briefly described below:

- **Omnis, the application environment**. Because Omnis applications are workstation independent, $SumMIT can be executed on any platform supported by Omnis (currently including the Macintosh and Windows 3.x).

  Thus, a single set of development, documentation, and training has resulted in an application that runs on two platforms.

Note: Omnis programs can simultaneously access data from databases of various types (although the $SumMIT application currently accesses only an SQL/DS database).

- **DAL, a facility supporting client server architecture.** DAL makes the connection to the mainframe and allows $SumMIT to query the SQL database and retrieve the results.

  - **TCP/IP networking.** DAL utilizes the campus network, which is TCP/IP, allowing high speed mainframe/workstation interaction.

  - **Digital ISDN phones.** DAL can also utilize MIT's phone system to connect to the mainframe computer, but this method is considerably slower than networking.

  - **Other phone dialups.** DAL can also utiltize a phone system external to MIT at varying modem speeds to connect to the mainframe, but this method is considerably slower than networking.

$SumMIT application

1. Overview

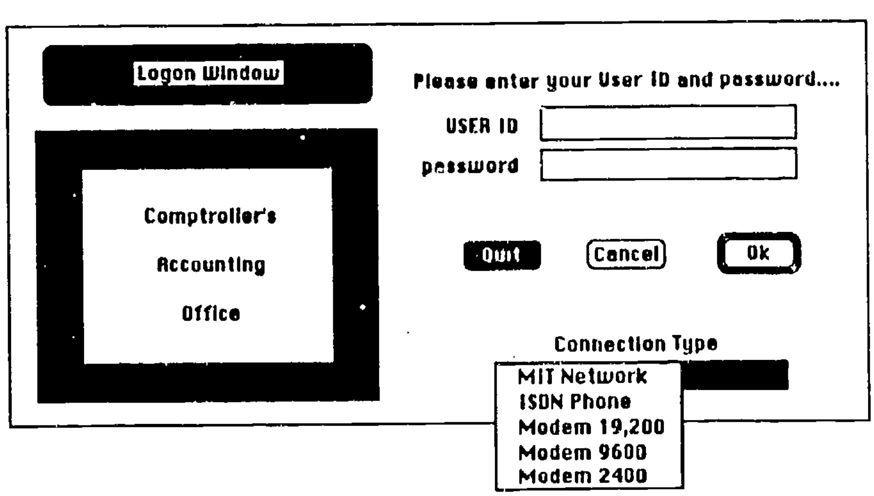
System purpose

The $SumMIT application, developed in Omnis software, provides user friendly access to accounting data in a SQL/DS database on an IBM mainframe. All reports run on the subset of Institute accounting data to which the user has access. Some reports are especially for "power users" (users who can access all Institute data).

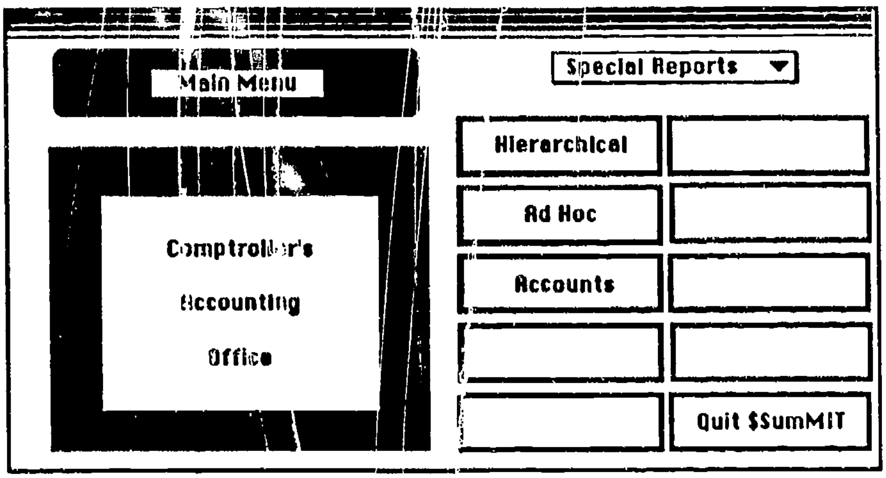
Most options can be performed by clicking your mouse on buttons or selecting items from menus or lists. Reports can be "exported" to your desktop into spreadsheets or word processors or printed on your local printer.

Log on

To access $SumMIT, once it's been installed, you double click on its icon. The logon screen displays, as shown below.



After you select your Connection Type, and enter your userid and password, the $SumMIT main menu displays, as shown below.



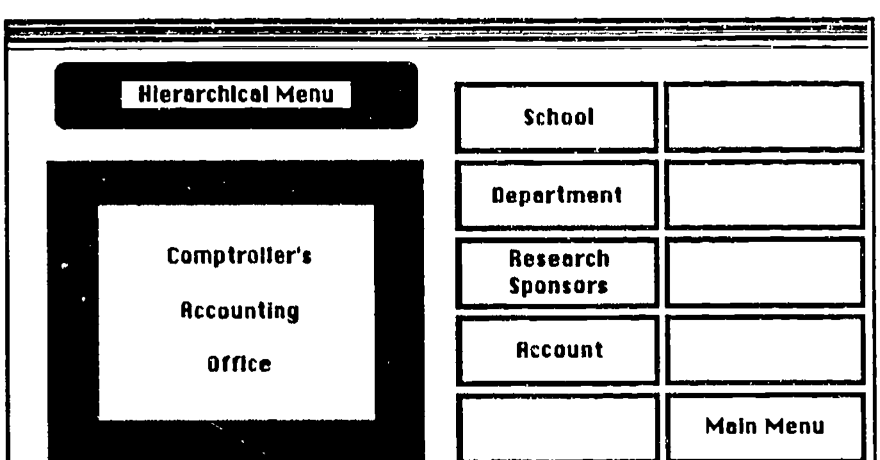
$SumMIT currently includes four options—hierarchical, ad hoc, and special reports and the accounts menu. These options are described below.

2. Hierarchical reports

The $SumMIT hierarchical reports are preprogrammed reports that can be run on current or historical accounting data.

The current year reports show expenditures (FYD) and budgets for the current and prior fiscal years, as well as percent growth of expenditures and budgets (for a sample report, see the next page). The historical reports show fiscal year expenditures for each year back to 1978 (none shown).

When you select "current" or "historical" from the Hierarchical main menu, the screen shown below displays.



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The reports display data by school, department, research sponsor, or account. To select a report, click on its button. An example of the current school report is shown below.

After running a school, department, or research sponsor report, you can break the data down further. For example, you can break down school data into data for its departments. An example of a department report is shown on the next page.

Below is the school report run on current accounting data. You can display a report on the departments within a school, for example Architecture, by double clicking on the school's line.

School Summary Report using Current Data

School	Sum(FYD'93)	Sum(Bud'93)	Sum(FYD '92)	Sum(Bud '92)	EXPE GROW %	BUDG GROW %
Architecture	6,313,599	30,547,798	6,530,275	27,086,770	-3%	13%
Engineering	41,534,154	167,000,735	42,095,942	167,675,507	-1%	
Humanities	6,218,276	28,413,512	6,465,654	27,933,048	-4%	2%
Management	9,393,639	36,036,396	8,768,454	40,383,366	7%	-11%
Science	38,690,326	155,351,191	37,073,717	151,281,561	4%	3%
Other.Acad.	14,329,388	187,067,314	11,747,192	179,920,264	22%	4%
Whitaker	9,270,505	11,379,814	8,846,594	11,932,201	5%	-5%
Interdpt.Lab	24,405,795	5,222,398	24,851,431	4,432,267	-2%	18%
Library	4,420,668	14,264,725	4,009,536	13,612,524	10%	5%
Non.Academic	87,298,754	451,473,419	112,510,059	428,917,906	-22%	5%
Total	241,875,104	1,086,757,302	262,898,853	1,053,175,414	-8%	3%

Double Click on Entry to see Departmental Breakdown

Hierarchical "Current" Menu | Hierarchical Main Menu

The department report for the school of Architecture is shown below.

Department Summary Report

Department Summary Report for Architecture

Department	Sum(FYD'93)	Sum(Bud'93)	Sum(FYD '92)	Sum(Bud '92)	EXPE GROW %	BUDG GROW %
Arch.Hdq	257,467	1,531,321	428,225	1,414,822	-40%	8%
Arch.Dpt.Hds	67,708	270,833	91,920	315,753	-26%	-14%
Arch.Special	54,907		133,769		-59%	
Architecture	788,076	5,313,894	1,170,169	5,073,851	-33%	5%
Aga.Khan.Prg	146,875	1,635,550	312,019	1,028,737	-53%	59%
Real.Est.Dev	329,503	2,358,135	314,496	1,919,460	5%	23%
Urban Studie	1,011,675	4,425,836	1,008,400	4,302,047		3%
Media.Arts.S	252,322	1,683,849	301,675	1,479,657	-16%	14%
LAP			-6,293		-100%	
CAVS	35,986	104,710	21,563	239,617	67%	-56%
Media.Lab	3,369,080	13,223,670	2,754,331	11,312,826	22%	17%
Total	6,313,599	30,547,798	6,530,275	27,086,770	-3%	13%

Double Click on Entry to see Account Type Breakdown

Hierarchical Main Menu

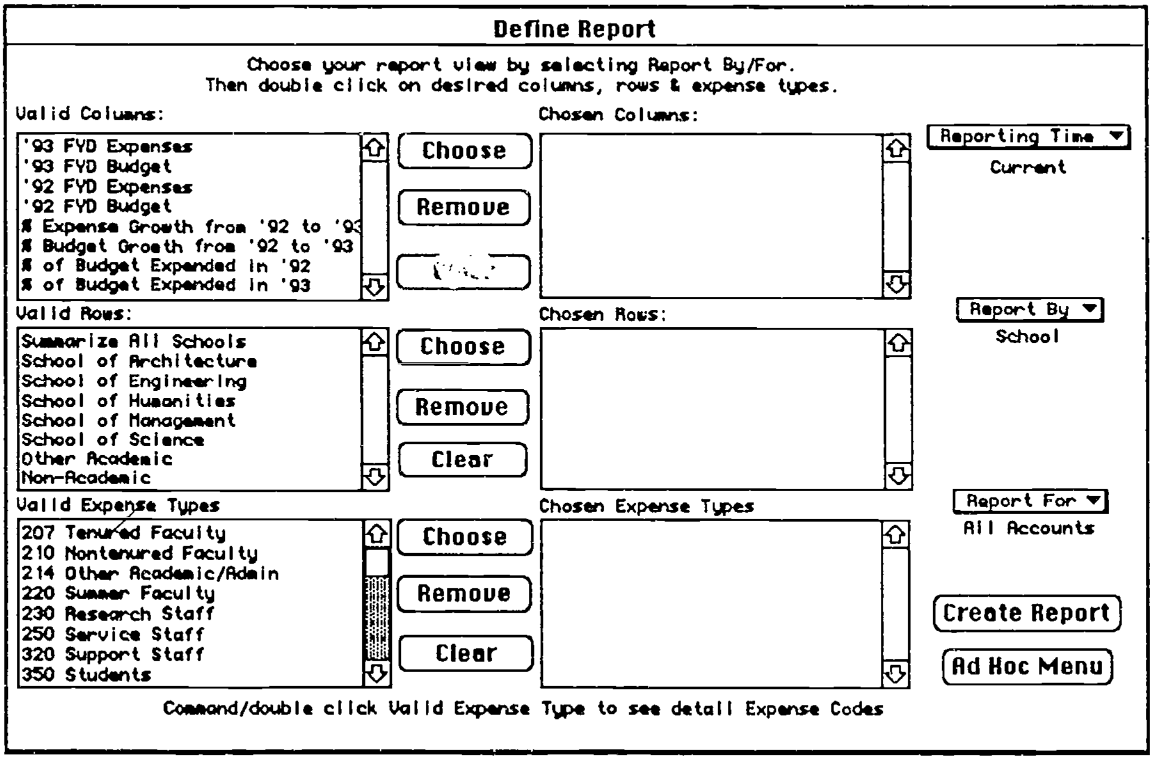
3. Ad hoc reports

You can run "ad hoc" (or user-defined) reports on current or historical accounting data. Reports run on current data compare expenses and budgets for the selected expense types for the current and prior fiscal years. The historical reports compare expenses for expense types over the last fourteen years. You select the expense types (or "object codes", as they are called at MIT) to compare for the chosen rows and columns.

When you select "Ad hoc" from the main menu, a screen for selecting current or historical data displays (not shown).

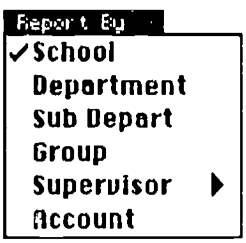
Current reports

If you select "current", the screen shown below displays.



Your choice of "current" or "historical" determines valid report columns, as shown in the top leftmost screen box. (To cycle between "current" and "historical", you can use the Reporting Time pull down menu at the top right.)

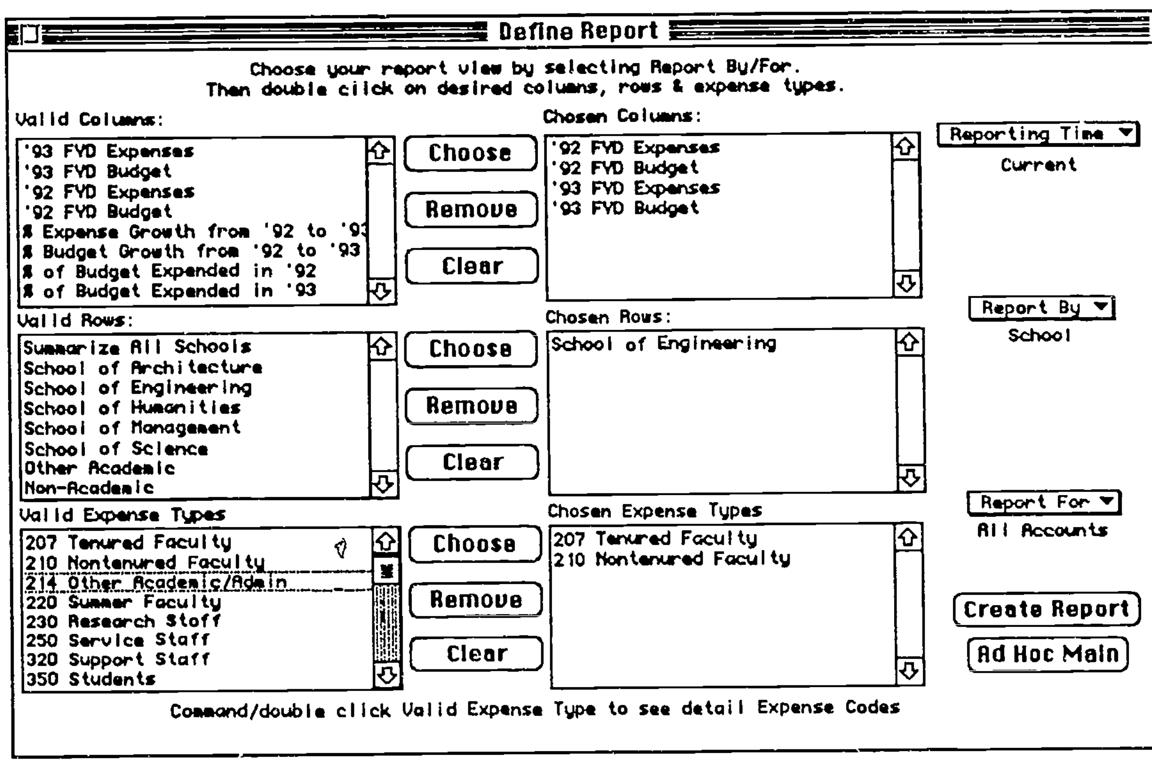
To display valid report rows, as shown in the middle lefthand box, you select a "Report By" option (see below). The default option is by "School".



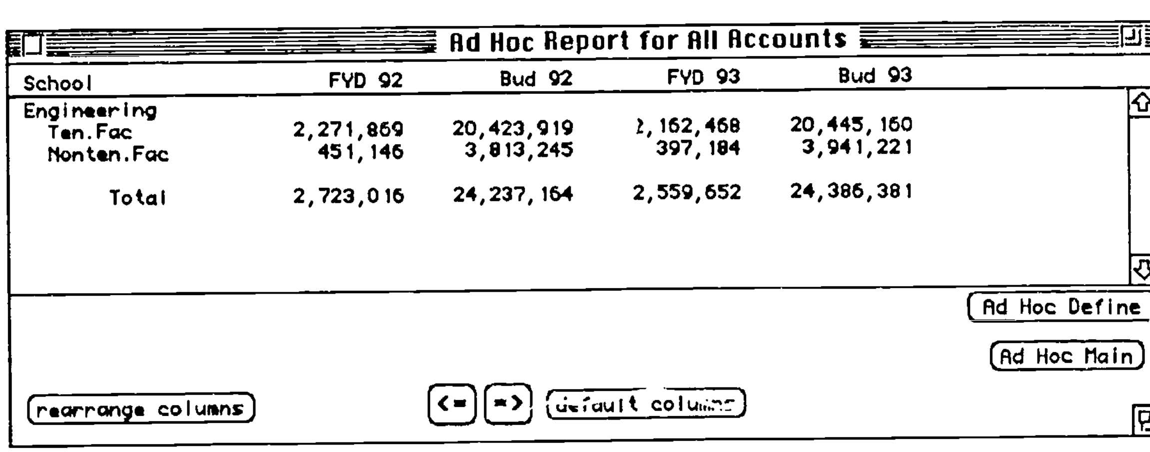
The default "Report For" option is "All Accounts", resulting in four reports, one each for general, fund, research, and all accounts. Other options are to display only the "General", "Fund", or "Research" report.

To create a report, you need to select columns, rows, and expense types to compare. To select a column, row, or expense type, you highlight its line in the lefthand box and click on "Choose" to copy it to the right hand box.

The sample screen below defines a report on current and prior year expenses and budgets in the School of Engineering for expense types 207 and 210 (faculty salaries tenured and non-tenured).



A sample report for All Accounts is shown below.

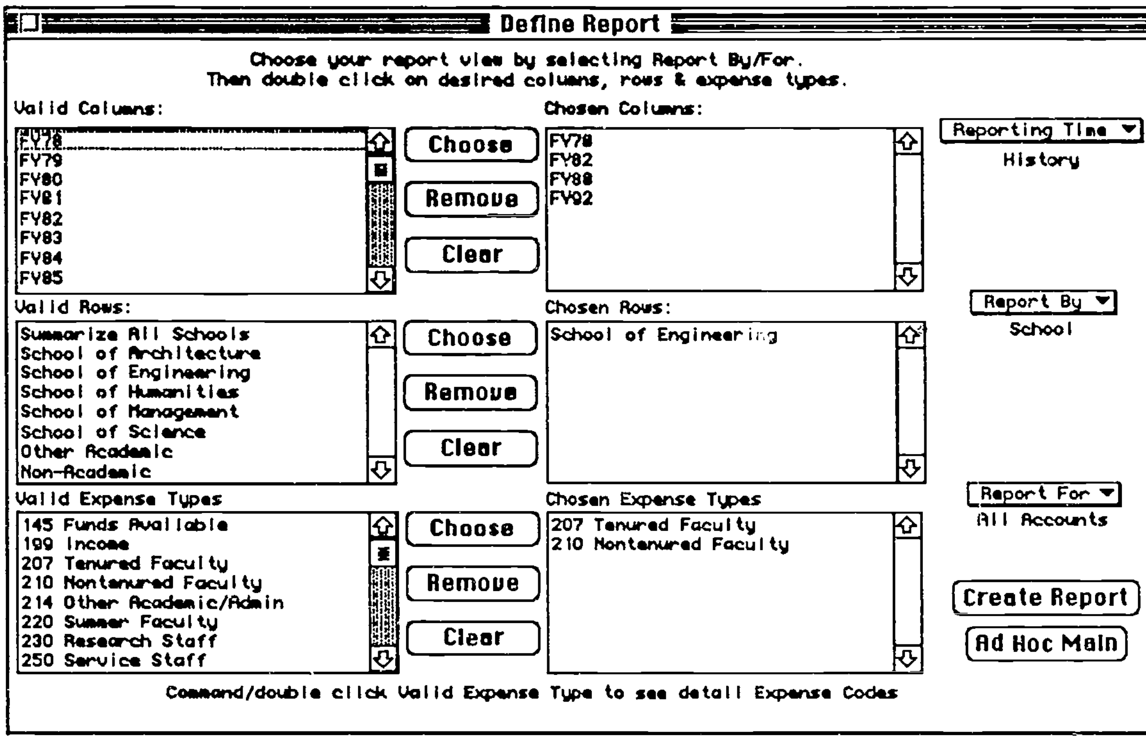


School	FYD 92	Bud 92	FYD 93	Bud 93
Engineering				
Ten.Fac	2,271,869	20,423,919	2,162,468	20,445,160
Nonten.Fac	451,146	3,813,245	397,184	3,941,221
Total	2,723,016	24,237,164	2,559,652	24,386,381

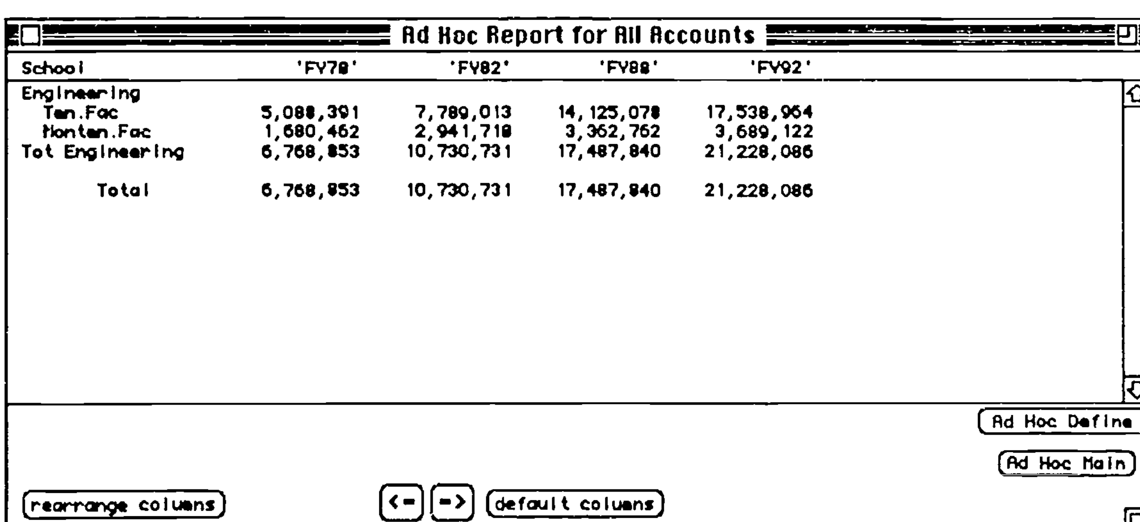
Historical reports

If you select "historical" from the ad hoc Reporting Time menu, the screen shown below displays (except that no columns, rows, or expense types are selected). The columns available (top lefthand box) include year end data for 1978-1992.

The sample screen below defines a report on year end data for 1978, 1982, 1988, and 1992 from the School of Engineering for expense types 207 and 210.



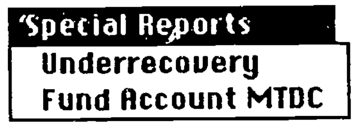
To run the report, click on "Create Report". A sample report for All Accounts is shown below.



School	'FY78'	'FY82'	'FY88'	'FY92'
Engineering				
Ten.Fac	5,088,391	7,789,013	14,125,078	17,538,964
Nonten.Fac	1,680,462	2,941,718	3,362,762	3,689,122
Tot Engineering	6,768,853	10,730,731	17,487,840	21,228,086
Total	6,768,853	10,730,731	17,487,840	21,228,086

4. Special reports

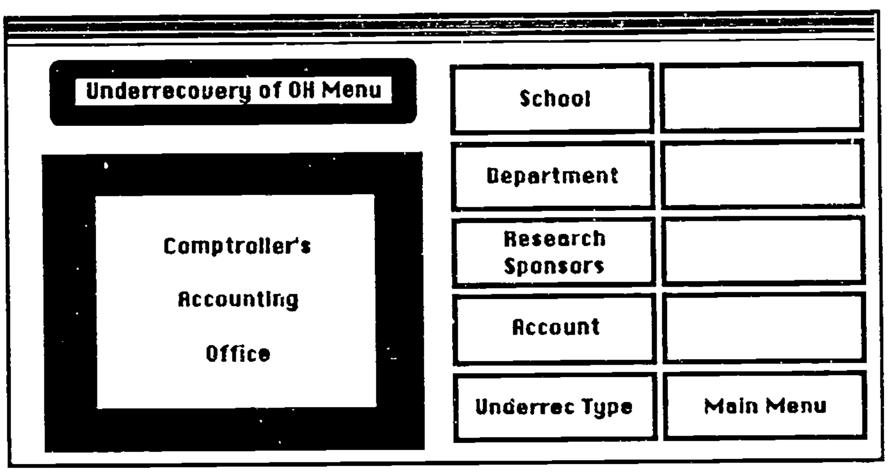
This section describes the reports on the Special Reports menu, shown below, which is for power users only.



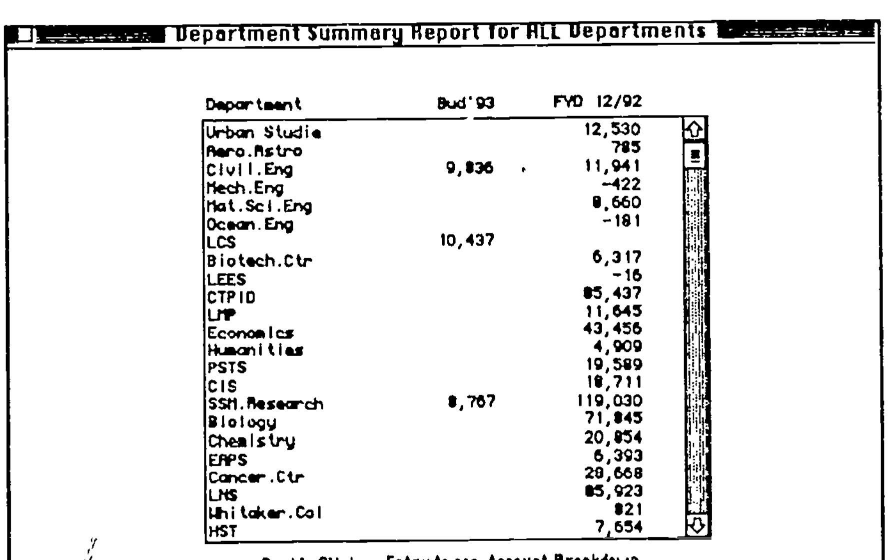
Underrecovery reports

The term "underrecovery" applies to accounts on which MIT "underrecovers" operating expenses (that is, the overhead rates are lower than the standard rate). The underrecovery report gives MIT's high level financial officers a means of projecting and tracking underrecovery.

When you select "Underrecovery" from the Special Reports menu, the menu shown below displays.



You can run underrecovery reports by school, department, research sponsor, account, and underrecovery type. The department report is shown below.


Department Summary Report for ALL Departments

Department	Bud'93	FYD 12/92
Urban Studie		12,530
Aero.Astro		785
Civil.Eng	9,836	11,941
Mech.Eng		-422
Mat.Sci.Eng		8,660
Ocean.Eng		-181
LCS	10,437	
Biotech.Ctr		6,317
LEES		-16
CTPID		85,437
LMP		11,645
Economics		43,456
Humanities		4,909
PSTS		19,589
CIS		18,711
SSM.Research	8,767	119,030
Biology		71,845
Chemistry		20,854
EAPS		6,393
Cancer.Ctr		28,668
LNS		85,923
Whitaker.Col		821
HST		7,654

Double Click on Entry to see Account Breakdown

The Bud column displays underrecovery budget dollars; the FYD column displays actual underrecovery dollars (object code 961).

You can further analyze the data by double clicking on a row, for example SSM.Research. The sample report below displays the underrecovery data for SSM.Research by account number.

To display the underrecovery budget record for an account, click on the account line to highlight it. For example, the underrecovery budget record for account 76354 displays at the bottom of the sample screen.

Account Breakdown for SSM.Research

Acct *	Department	Sponsor	Bud'93	FYD 12/92
75362	SSM.Research	Nonprofits		113,365
75393	SSM.Research	Nonprofits		711
76354	SSM.Research	NSF	8,767	4,954
	Total		8,767	119,030

(* = no underrecovery budget) Double Click on Entry to see Account Information

Fiscal Year	1993	School	Management	Proposal ID	
Underrec Type	Litster	Sponsor Grp	NSF		
Generic Category	NSF.WOMEN	Sponsor	NSF		
Remarks					

You can double click on an account's line to display chart of accounts data for the account (not shown).

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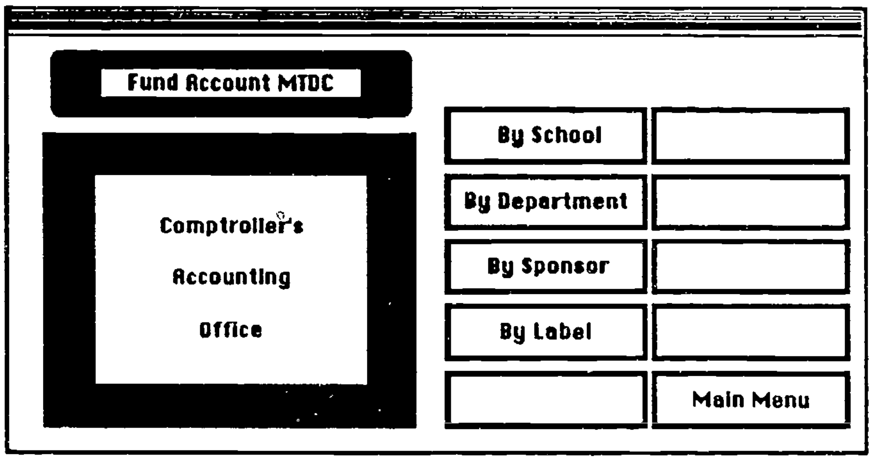
Fund account MTDC reports

This report shows the difference between two methods of calculating overhead on fund accounts (that is, MIT accounts drawing on gifts received for specific purposes).

When you select "Fund Account MTDC" from the Special Reports menu, the menu shown below displays.



You can run fund account MTDC reports by school, department, research sponsor, and label. For example, the label report is shown below.

Label Summary Report for All Labels

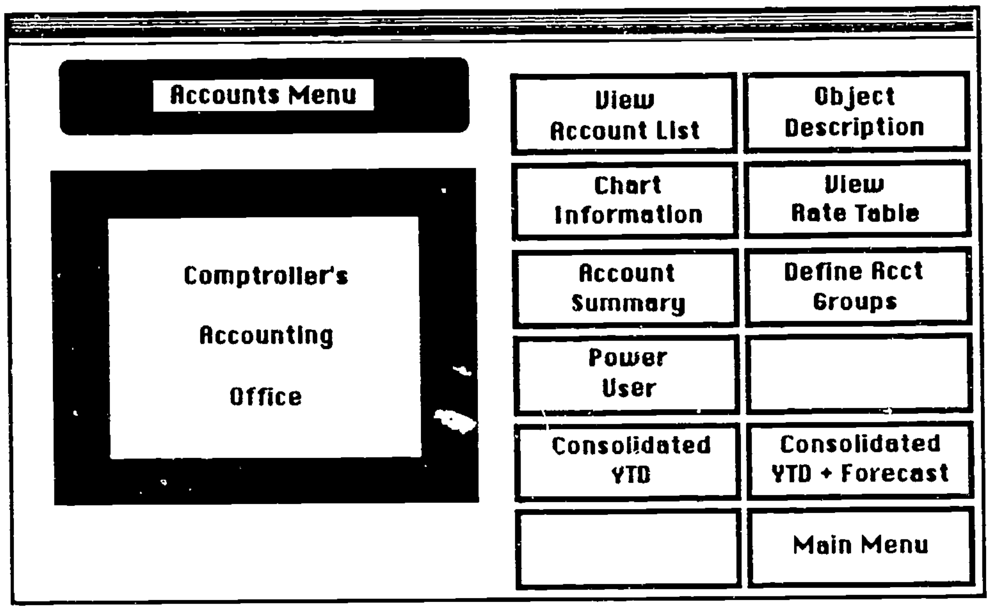
			IDC - Salary Base		IDC - MTDC	
Label	Impact	TDC	Bill Rate	Actual	Bill Rate	Actual
Professorship		9,657,567	5,022,315		4,613,381	
Career Development		2,002,496	836,460		856,081	
MIT Revenue Sharing		1,569,276	385,525		751,391	
Athena		109,994	3,397		10,404	
CAES		3,719,855	799,827		1,697,369	
Aga Khan		609,797	226,184		264,451	
No Sponsor-Zero IDC		5,761,950	1,971,800		2,443,121	
NSF Pres.Young Inves		1,845,621	844,491	246,245	855,228	246,245
Other Fed-Fixed IDC		333,259	162,886	31,396	126,781	31,396
Draper/Whitehead Fel	-72,525	2,043,106	290,658	290,658	218,134	218,134
Non-Fed Fixed IDC		3,042,768	993,343	81,761	1,147,800	81,761
Fellow/scholarships	782,370	13,095,483	50,723	49,914	832,284	832,284
Sloan Bas/Solar Enrg	428,651	1,371,798	73,478	73,478	502,129	502,129
Collegium	2,166,181	9,373,792	666,915	664,807	2,830,988	2,830,988
Research	1,114,253	3,711,981	308,570	302,169	1,416,421	1,416,421
Education	469,416	1,446,690	159,810	159,810	629,226	629,226
Departmental	2,031,845	15,367,350	714,635	726,591	2,758,435	2,758,435
Total:	6,920,191	75,062,784	13,511,016	2,626,827	21,953,624	9,547,018

Double Click on Entry to see Account Breakdown

You can further analyze report data by double clicking on a row, for example Research.

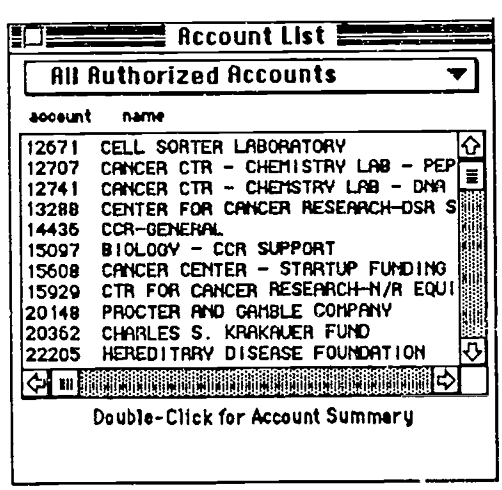
5. Accounts menu

When you select "Accounts" from the main menu, the Accounts menu displays, as shown below. This section describes some of the options on the Accounts menu.



View Account List

From the top window, click on "View Account List" to list the five-digit account numbers accessible to your userid. (At MIT "account numbers" represent sources of authorized income to which expenditures can be charged.) A sample screen is shown below.



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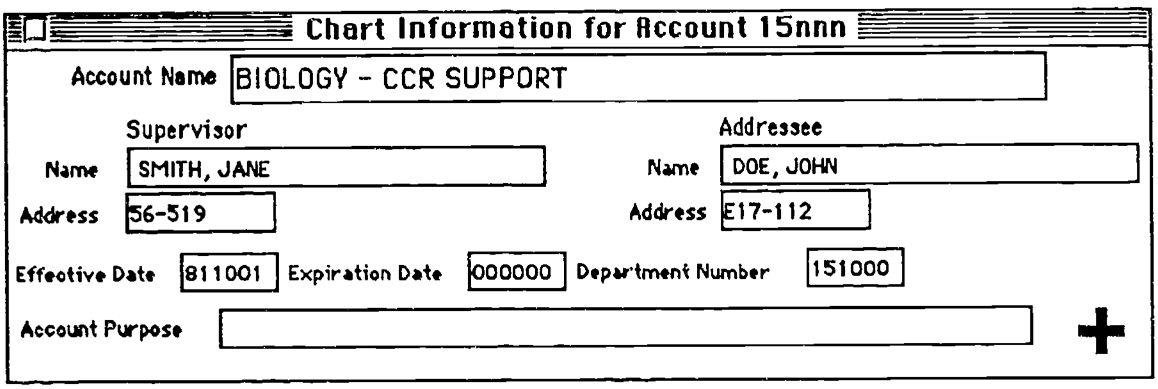
Options available by account

The table below describes options available for an account or account group. Users can create account groups using the "Define Acct Group" option on the Accounts menu.

For...	you can ...
a single account	• display chart information (see below). • display an account summary report (see below).
a single account or an account group	• run YTD reports (see next page), including actuals by expense type for the current month or all months in the fiscal year to date.

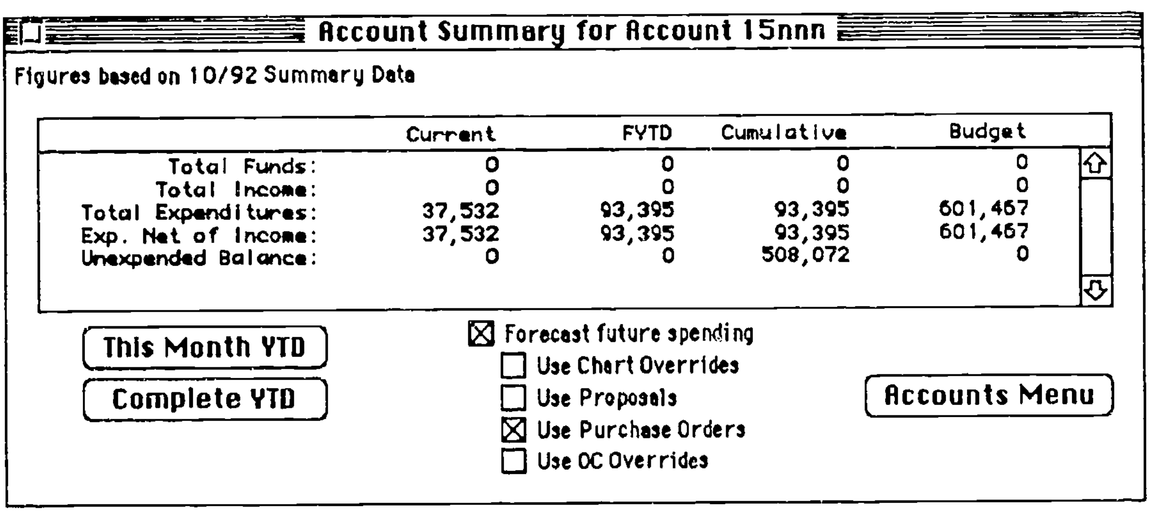
Chart information

A sample screen of "chart information" for an account is shown below.



Account summary report

An example of the account summary report is shown below. The columns are: current month expenditures (Current), FYTD expenditures, cumulative expenditures (for accounts with life spans of more than one year), and budget dollars.



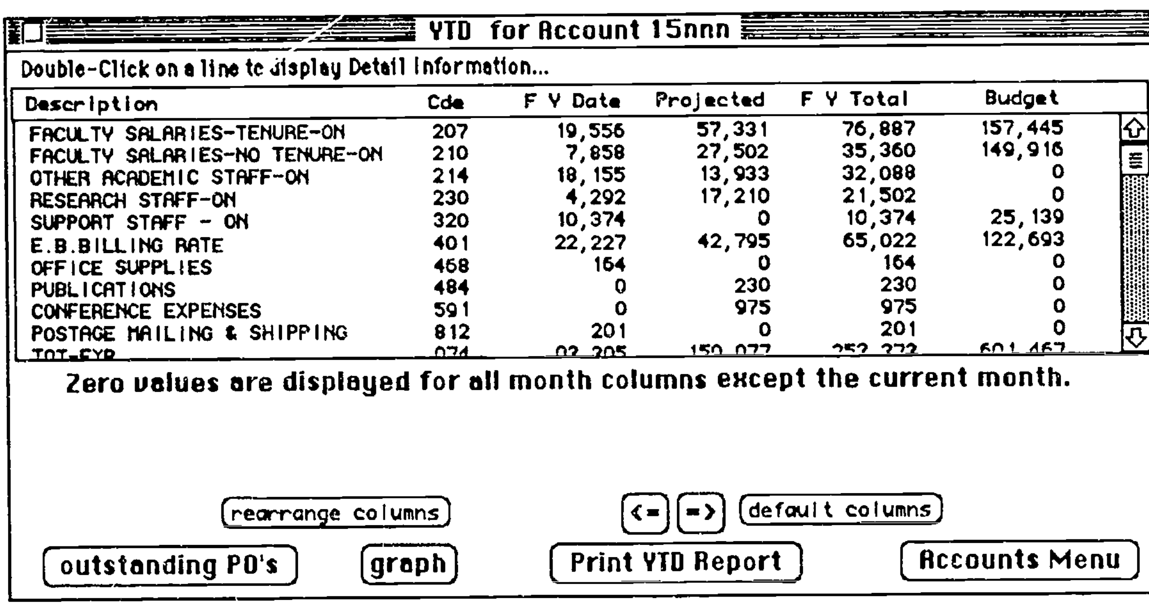
From the account summary report, you can run the account's YTD report. This report displays expenses by expense type; it can include a forecast of future spending for the months remaining in the fiscal year (based on algorithms outside the scope of this paper).

The "this month YTD" report includes current month actuals only. The "complete YTD" report includes monthly actuals for each month in the fiscal year to date.

YTD reports

A example of the YTD report is shown below. You can run a YTD report on a single account or an account group.

The report columns are fiscal year to date expenditures (F Y Date), projected expenditures for the months remaining to the end of the fiscal year (Projected), the sum of these two columns (F Y Total), and the account's fiscal year budget (Budget). By comparing the F Y Total and Budget columns, you can determine if the account is projected to be overrun (that is, if expenses are projected to exceed available funding).



Description	Cde	F Y Date	Projected	F Y Total	Budget
FACULTY SALARIES-TENURE-ON	207	19,556	57,331	76,887	157,445
FACULTY SALARIES-NO TENURE-ON	210	7,858	27,502	35,360	149,916
OTHER ACADEMIC STAFF-ON	214	18,155	13,933	32,088	0
RESEARCH STAFF-ON	230	4,292	17,210	21,502	0
SUPPORT STAFF - ON	320	10,374	0	10,374	25,139
E.B.BILLING RATE	401	22,227	42,795	65,022	122,693
OFFICE SUPPLIES	468	164	0	164	0
PUBLICATIONS	484	0	230	230	0
CONFERENCE EXPENSES	591	0	975	975	0
POSTAGE MAILING & SHIPPING	812	201	0	201	0

You can select report options, as needed, including:

- display additional report rows and columns (to display additional columns you click on the right and left arrows above the "Print YTD Report" button),
- rearrange report columns (by clicking on the "rearrange columns" button and selecting the columns to be displayed in the order of display from a list),
- display detail by expense type by double clicking on a line (for a sample report, see the next page),
- within salary expense type, display complete salary distribution for a person,
- display outstanding PO's,
- graph report data for salary or other expense types (see next page for more).

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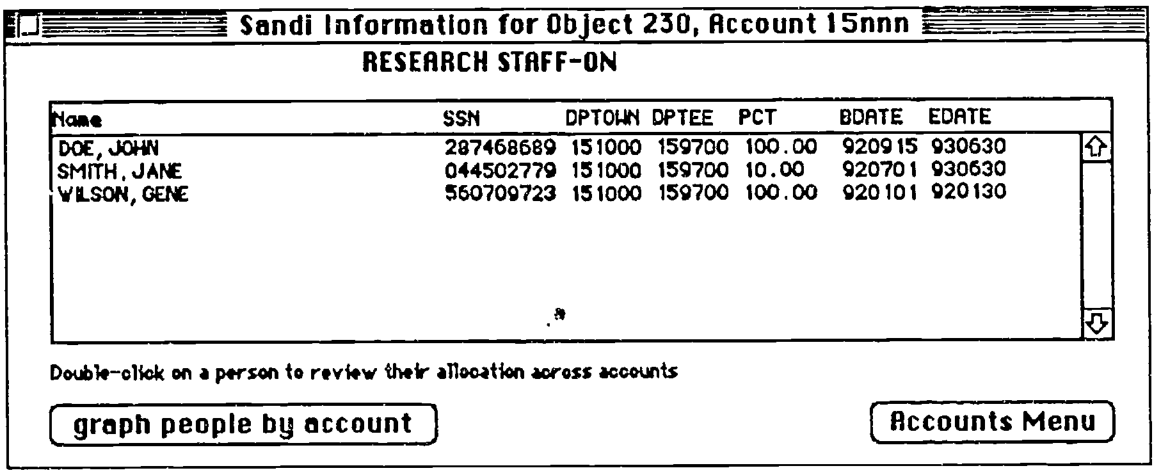
Below is a sample detail screen for expense type 230 (Research Staff - On Campus).



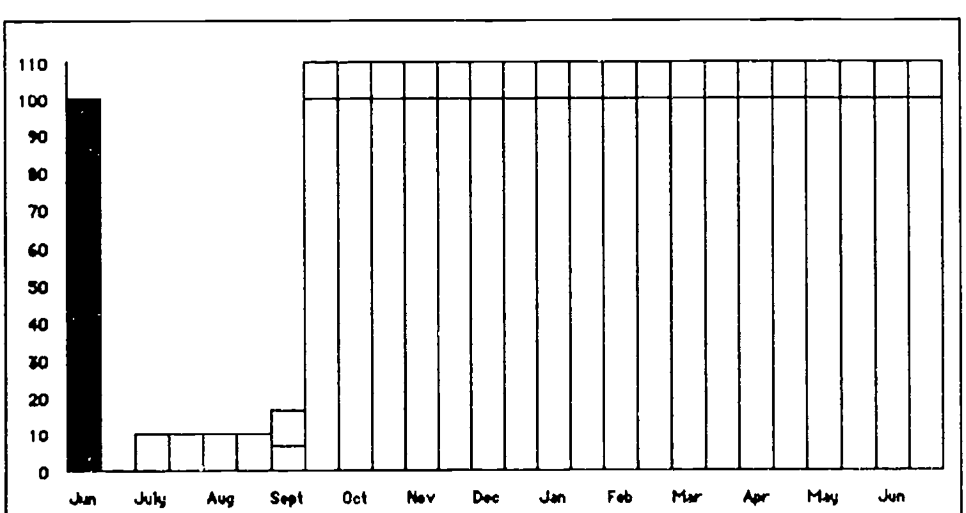
Name	SSN	DPTOWN	DPTEE	PCT	BDATE	EDATE
DOE, JOHN	287468689	151000	159700	100.00	920915	930630
SMITH, JANE	044502779	151000	159700	10.00	920701	930630
WILSON, GENE	560709723	151000	159700	100.00	920101	920130

Graphing options

Within YTD reports, you can graph data by expense type, as described below.

For...	you can graph...
salary expense types	• for an account, percent salary distribution by person. • for a person, percent salary distribution by account.
other expense types	• single expense type by month. • FY Date, Projected, FY Total, and Budget columns for two expense types. • YTD spending for all expense types.

Below is a graph projecting research staff salary distribution to an account (in percent) for the fiscal year. In $SumMIT the graph uses three colors, one for each person.



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M4-3

Implementation of a Voice Response Unit Within the University of Michigan's Accounts Payable and Travel Audit Office

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Introduction

The University of Michigan is one of the premier research universities in the world. More than 50,000 students are enrolled at the University's three campuses located in Ann Arbor, Flint and Dearborn. A total of $346,000,000 was spent on research activities during fiscal year 1991-92. Total revenues from all operations of the University totalled more than $2 billion during fiscal year 1991-92.

The Financial Operations Office is the central accounting office for the University. Approximately 160 employees work in the various fund areas and service organizations within Financial Operations. The Accounts Payable and Travel Audit Office processes approximately 90 percent of all non-payroll disbursement transactions for the University. This office processed over 750,000 transactions during fiscal year 1991-92. Many of these transactions were vendor invoices for products/services rendered through the University's Purchasing Department. When a University department needs a particular item that is not available from our Stores operation (a large warehouse that stocks many of the basic items needed on a day-to-day basis), they are to complete a Purchasing Requisition. A purchase order number is then assigned and the order is sent to the vendor. The products/services are provided and the vendor submits an invoice to the University's Accounts Payable and Travel Audit Office, noting the purchase order number on the invoice. The invoice is then audited by our office by comparing the items on the invoice with what was actually ordered on the purchase order. If everything matches, a paydate is assigned to that invoice and recorded on the database.

The database management systems that are used at the administrative data center are IMS (Information Management System), DB2 and Oracle. IMS is the main on-line and batch database processing operating system that supports all the application systems for the major administrative departments

(i.e. Financial Operations, Payroll, Purchasing, Personnel, Registrar, Admissions, Student Accounts, etc...). The administrative data processing system supports a large 3270 network for both on-line and remote dialup. Users (University departments) can access administrative systems, E-mail, and the gateway to Internet. The system is accessible by employees of all three campuses.

The current Purchasing/Accounts Payable database was created in 1978. The purchase order and purchase order invoice detail screens are widely used throughout the University. Approximately 110,000 purchase orders are created annually, which generates in excess of 375,000 vendor invoices.

Accounts Payable and Travel Audit Office

The Accounts Payable and Travel Audit Office perform the following functions for the University:

- Audits vendor invoices against the purchase order and approves the invoices for payment.
- Audits and approve for payment non-purchase order transactions (travel expense reports, Federal Express airbills, imprest reimbursements, etc...).
- Telephone customer service support for University departments and vendors.
- Imprest cash fund approval and reimbursement processing.
- Credit memo processing.

As the University grew in size and the volume of transactions increased in number during the 1980's, central administrative financial support suffered. The necessary staffing and systems enhancements were delayed time and time again. By the late 1980's, the Accounts Payable and Travel Audit Office had a horrible reputation throughout the University community and with the University's vendors for extremely slow payment and inadequate customer service support. In 1989, it was recognized that the University's overall image was being affected by this adverse situation. The beginnings of a "Quality" movement were spreading through certain areas of the University and it was decided to make every reasonable effort to improve the image and quality of work performed by the Accounts Payable and Travel Audit Office. There were two underlying reasons for doing this:

1. The Accounts Payable and Travel Audit Office was one of the primary contacts with the outside community.

2. The poor quality of the Accounts Payable and Travel Audit Office adversely affected many other areas within Financial Operations.

During the 1980's, one person was assigned the responsibility of answering the telephones. This person was equipped with a two-line telephone instrument, a headset and a computer terminal to access the Purchasing/Accounts Payable database. If you have ever worked in a position where the telephone completely dominated your every move, then you may realize just how difficult this task was. Statistics are not available on how many calls this person handled per day, or how many calls could not get through because the line was busy. Assuming the average call is 2 minutes, the maximum number of calls this person could handle per day is approximately 200. Our Voice Response Unit currently receives 350-400 calls per day. Applying the same rates of volume increases to the number of calls as we know exists with the number of invoices processed, this tells us that in any given day, approximately 100-125 callers could not get through due to the line being busy. Many of the complaints registered against our office during the late 1980's were that of the difficulties of getting through on the telephone.

In 1989, we decided to increase the number of staff that were trained to answer the telephone from one person to four. A telephone group was established through our Telecommunications Office that would uniformly distribute calls to those in the group. Two representatives were in the telephone group at any given time. We thought this would provide more than enough service. We were wrong! The telephones continued to ring constantly and it was obvious that something else was needed. Many of the calls were very routine, for example; "Can you tell me if this invoice has been paid?" This required the representatives to do an IMS transaction and relay the information on the screen to the caller. This would prevent these employees from performing other necessary tasks.

We had a decision to make. Should we:

1. Increase staff to a level that can adequately process all of the requests received from the University departments and vendors?

2. Look into other technologies, specifically voice response units?

3. Investigate procedure and policy changes that may relieve the workload of our current staff to a more acceptable level?

We decided to immediately implement some procedural and policy changes, and begin looking into the possibility of obtaining a voice response unit. A few vendors were asked to do presentations and the decision was eventually made to purchase a voice response unit.

The Voice System

The Voice Response Unit consists of four main functions:

1. Telephone operations.

2. Application development and processing.

3. Screen identification.

4. Speech recording and usage.

The telephone operation covers many features that are performed in familiar telephone systems. The voice response unit can answer the telephone, transfer calls to both internal and external numbers, perform conference calls, put callers on hold and initiate calls. Telephone processing includes checking for several actions and inactions. These include monitoring the amount of time a caller is on the line without entering data, the amount of time it takes to get a dial tone, detecting a busy signal and incomplete call transfer or initiation.

Application development and processing include the preparation and coding of the actual script that will be used and its execution. It is the application that makes it possible for the unit to detect a specific screen and to act upon the data displayed. This includes the processing of a telephone call in the same sequence in which a person would handle the call. A simplified example is; answer the telephone, present the caller with the necessary options, process the request, communicate the requested information to the caller and gracefully terminate the telephone call or transfer the caller to another service representative.

Screen identification includes identifying those specific screens, such as an IMS screen from a mainframe, a microcomputer spreadsheet screen or a screen from a microcomputer database program. This also includes detecting blank, incomplete or unrecognized screens and processing the exceptions in a manner that does not cause the application to end unexpectedly. The voice response unit system provides a mechanism to specifically identify sections of the screen that the unit needs in order to process calls efficiently.

One important part of the application is the speech. Each response to the caller is a spoken word or phrase. Responses are coded as text in the application, then the text is associated with an audio recording and stored on disk as digital representation of the spoken voice. Storage of recorded voice requires a large amount of disk space, thus it is very important that phrases be kept as simple and short as possible. Short and concise responses will also make the system easier to use for the customer.

Considerations in System Design

Once other departments learned that we were going to purchase a voice response unit, some inquired about possible applications within their units. The University's Payroll Office and Staff Benefits Office both requested to be included in this venture. The Student Accounts Office (also part of Financial Operations) would also be included, in addition to the Accounts Payable and Travel Audit Office.

To provide the most efficient service to the targeted users, we implemented the voice response unit in a modular fashion, as recommended by the vendor. Three modules were purchased: one for the Accounts Payable/Travel Audit, Student Accounts and Payroll applications, one for the Staff Benefits application and the remaining module would be used for application development and maintenance.

When designing an application for a voice system, one should follow the standard system design rules and principles; such as develop modular code, develop reusable routines, build transaction tables, keep algorithms and Boolean logic simple. In addition, you need to be knowledgeable of the telephone system in use; the options available (call waiting, conference calling, etc...) and the screens that the voice system will access to retrieve the data. It is necessary to work closely with the telecommunications department and the data processing department when setting up your voice response unit.

The telecommunications department's involvement is to install the connections between the voice response unit, the telephone system and the computer system where the data originates. This could take months to complete. Data lines and voice lines will need to be installed. The administrator may need two voice lines; one for the administrator of the unit and another for the vendor to use to access your voice system for debugging purposes. The vendor we selected markets a dial-in package that proved very useful when there were problems with the system. They are able to access our application from their home office.

Data processing people are involved from the perspective that they manage the host computer that holds the data to be accessed by the voice response system. You probably won't be able to simply plug in the voice response unit, write an application, redirect your telephone and then sit back and watch the lights blink! The administrator will need to work with system security personnel to define new terminals and user ID's. The internal audit department may also need to be consulted. The EDP auditors on our campus were very concerned with the security issue. Since the transactions used were only inquiry transactions, we were able to get over this hurdle; however, if we had planned to update the IMS database through the voice response unit, this

would have been a much more difficult obstacle to overcome. In some cases, you may want a new screen designed or other mainframe programs enhanced. This may be necessary if you are searching through multiple screens for a few data elements. Very little of this can be completed prior to developing the voice script. While developing this script, it may become apparent that a modified screen will be required to decrease the desired response time. It will become even more important to have the data processing department involved as early in the application design as possible if you plan on updating or storing data on the mainframe.

3270 Emulation

Utilizing the IBM standard 3270 data transfer mode, the voice response unit appears as a dumb terminal on the mainframe network. Through the system utilization process, as with a terminal operator utilizing a terminal, the voice response unit sends the necessary transactions and passwords to the mainframe enabling it to sign on and access data. Once the voice response unit has successfully signed on, the system awaits an incoming call. Upon receipt of a call, it goes into the routine described below.

The Accounts Payable and Travel Audit Application

All of our customers' calls are processed through the voice response unit. By calling our main Accounts Payable and Travel Audit number, (313)764-8212, the caller is asked to press 1 if they have a touch-tone telephone. The next layer of the script contains the main menu. The various selections are:

- For purchase order information, press one.
- For Federal Express information, press two.
- For other freight information, press three.
- For Travel/Host Expense information, press five.
- For credit memo information, if your vendor name begins with the letter A-K, press six.
- For credit memo information, if your vendor name begins with the letter L-Z, press seven.
- To speak to a customer service representative, press zero.

Most of the callers will press one for purchase order information. All of the other selections use the voice response unit to direct calls to the appropriate section of the office. The purchase order information selection will lead the caller through layers of script to obtain payment information.

University of Michigan purchase order numbers begin with a letter and are then followed by five numbers (F38452). One of the IMS transactions that is utilized extensively by our office is the purchase order invoice information transaction. The user would signon to IMS, go through the necessary security process and type in the following:

POINV F38452

After pressing the ENTER key, the following screen would appear:

```
PO# F38452-00000 DATE 05/07/92                          VENDOR# 13754N
POSTAT O FOB    CD (NET/30)                             FAIRLANE FORD SALES,INC
POTOT 9000.00       INVTOT 14.04          POITM 1       14585 MICHIGAN AVE
ACCT 238751 2452    CM TOT 0.00           IVITM 0       DEARBORN                  MI 48126
AUTH SIGNOR J RODGERS
REQCDS BS BL NB
FOLLOWUP  06/18/92  NOTICE DTE                    NOTICE NO 000 AMENDS 001 BUYER  JBS
CONTRACT PERIOD 07/01/92-06/30/94
PO SUPERCEDES PO# CE61170
AMEMO 01 RECEIVED CM 6891 TO CANCEL INV 6289. TLB 9-9-92

INVOICE NUMBER    DATE     ST  INVOICETOT  NET AMOUNT  PAYDATE   APRDATE BATCHSEQ
UN5210          09/24/92 DN      42.94       42.94                              -
12227           10/05/92  N      14.04       14.04 11/06/92               J5G00-14
                               CHECK# 917201 11/06/92 CP# 382048 RL# 00000
13189           10/12/92 WN      81.28       81.28                        F1J00-49
14353           10/20/92 WN      47.85       47.85                        F1J00-48
6289            08/14/92 WN      25.50       25.50                        F1J00-45
6937            08/27/92 WN      25.50       25.50                        F1J00-44
97839           07/06/92 WN      12.16       12.16                        F1J00-47
98848           07/13/92 WN      32.89       32.89                        F1J00-46
                                                                 **** CONTINUE ****

Alt-Z FOR HELP° VT102    ° FDX °  9600 E71 ° LOG CLOSED ° PRINT OFF ° ON-LINE
```

This screen has always been widely used by our service representatives to answer inquiries from University departments and vendors. This screen includes the vendor name and address, payment terms, invoice number, invoice date, purchase order status, invoice total, net amount to be paid, the check number and checkdate if already paid and other necessary information.

If a previously working voice response unit application suddenly begins relaying scrambled information, then someone has probably changed the format on one of the screens your application is accessing. It is CRITICAL that there is a procedure in place that will enable you to be notified whenever a screen used in the application is going to be modified! Learning of a modification AFTER it occurs WILL CAUSE MAJOR PROBLEMS. You also will need to be notified if another screen is being added or a screen is being removed from the mainframe application. We created a separate transaction that was a mirror image of the POINV screen, with explicit instructions not to modify this transaction without our approval.

Our callers are asked to enter the initial letter of the purchase order number. In this example, the caller would press the #3. The #3 on a telephone contains the letters D, E and F. We had to include another layer in the script to get around this situation. The caller is instructed that if the purchase order number begins with a D, to press one; an E, to press two; an F, to press three. This will inform the voice response unit of the first character of the purchase order number. The caller is then prompted to enter the remaining numbers of the purchase order; in our example we would press the 38452 keys on the telephone. In order to reduce the amount of information relayed to the caller for lengthy purchase orders, the caller is asked to provide the invoice date of the invoice in question. We considered using the invoice number, but many invoice numbers contain dashes, asterisks, letters, etc. This would have required that additional layers be installed to identify the specific invoice in question. Therefore, we decided to use the invoice date. Callers are instructed to enter the date in the following format:

MMDDYY

This supplies the necessary information to the voice response unit to deliver only the desired information.

In our example, once the purchase order number F38452 has been entered and the invoice date of October 5, 1992 (this would have been entered 100592) has been supplied, the voice response unit will read the IMS screen and integrate the information on this specific screen with standard speech instructions as follows:

Standard Speech	Specific Screen Information
Invoice Number	12227
Dated	October 5th, 1992
In The Amount Of	Fourteen dollars and 4 cents
was paid on	November 6th, 1992
check number	917201

If an invoice has been assigned a paydate, but a check has not been prepared, the voice response unit will respond with "the invoice is scheduled for payment on . . . . .". In our example, many of the invoices have a "W" in the status field. This means that the invoice has been received but has not been processed for payment. The voice response unit will relay the information that the invoice is "in process." At the end of each request, we ask the caller if they want the information repeated, or if they want information on another purchase order, or if they wish to speak to a service representative. Depending on their selection, the caller will be returned to the appropriate section of the application. While the voice response unit is waiting for the IMS screens, phrases like "One Moment Please" or "Please Hold While We Search Our Database" should be utilized. Otherwise, the caller will be hearing nothing but silence on the line and may think that the unit is not working.

Many of the questions which callers have cannot be answered by the voice response unit. The callers are given the option of talking to a service representative many times throughout the Accounts Payable script, by pressing the "0" anytime from within the application. The voice response unit will automatically transfer the caller to a service representative if the invoice in question has a status of "F" in the status field. This means that an invoice did not pass audit, and there is a problem that needs to be corrected before a paydate can be assigned. There is no further information that the voice response unit can provide on these invoices, therefore, the caller is automatically transferred to a service representative.

Developing the Applications

As mentioned previously, one module contained the applications for Accounts Payable and Travel Audit, Student Accounts and Payroll. The term "applications" may not be the most accurate. Actually, they were sections of the script within one large application. This had its advantages: utilizing standard routines such as checking for non-touchtone telephones; error situation messages; call transfer procedures and screen paging.

If it becomes necessary, however, to create unique messages where a standard message was used, the advantages of standardization have suddenly turned on you. Not only do you need to determine how to create the uniqueness, you need to locate all instances where the standard message was used, make the changes and test the changes for correctness. This may be a very difficult task.

It may be unwise to combine multiple applications into a single script if the applications belong to different departments. This is often done to reduce the cost of the hardware, although the complications that this can cause may

result in expenses greater than those for additional hardware. The primary problem is if one of the applications fails to operate properly, and it gets to the point that the voice response unit needs to be stopped during the day for repairs, then all the processes within the script are out of operation until the repairs are made. There are some ways to get around this; however, they are not foolproof or necessarily easy.

It is not always, however, a bad idea to combine applications into one script. Consider situations where the application is small and requires little script code. You may be able to tack this on with a larger one; or combine some that can be stopped during the day and left off-line until evening. It must be pointed out though, that the ramifications of combining multiple applications into a single script need to be carefully examined.

In our application, we initially had the Accounts Payable and Travel Audit, Student Accounts and Payroll applications together on the same module. The Accounts Payable and Travel Audit application was the first to be used. With the Accounts Payable and Travel Audit application on-line, work was being done on the Student Accounts application. Problems occurred when part of the script was changed in the Student Accounts script, not realizing the effect on the Accounts Payable and Travel Audit section. After several similar occurrences, it was decided to install each office's application on separate modules.

Installation Timeline

August, 1990	Purchasing requisition prepared.
December, 1990	Voice Response Unit delivered.
February, 1991	Vendor representative spends one week installing unit and also providing limited in-house training. Extensive work done on the script at this time.
April, 1991	Administrators of the unit attended intensive one week training at vendor home office.
September, 1991	Accounts Payable application goes "LIVE."

Initial Community Reaction

We previously mentioned that the image of the Accounts Payable and

Travel Audit Office was very poor. Installing this voice response unit, initially, did not help this situation. Many people despise voice response units. We received numerous complaints.

One of the problems we had was the time it took our telephone representatives to get to the callers on hold after they had gone through the voice response unit process. There are eight telephone lines coming into the voice response unit. Initially, we had two service representatives signed into the telephone group at any given time, with a queue of five callers waiting to talk to a service representative. The total number of callers at any given time would be a maximum of 15 (eight callers using the voice response unit, plus five that have been through the voice response unit, elected to speak to a service representative and on hold waiting for the next available representative, plus two talking to the service representatives). We started getting complaints of people being on hold for LONG periods of time. We underestimated the length of time it takes our service representative to handle a call. The voice response unit is quick, and when it was done and the caller wanted to be transferred, the caller would get in line in the queue of five. This queue was later reduced to two. This cut down the complaints. If the queue is full when the voice response unit tries to transfer a call, they get a message instructing them that all operators are busy and they will need to call back later.

We also added music for people waiting in the queue to talk to a service representative. This let the caller know that the unit didn't hang up on them.

Many people simply said "I hate it!" While others had very positive comments. It took about six months to educate enough callers. The service representatives spent much of their time "teaching" the callers that they could have gotten this information much quicker by using the voice response unit. The number of complaints has significantly reduced over the last six months. One of the initial responses said that "once I LISTENED to the instructions it was a very easy system to use." Most people do not listen very well, and this was the brunt of the problem, initially. Many people thought that this may be just an experiment that will go away if they complain long enough and loud enough. It's critical to have the support of your executive officers, because they WILL get complaints! But if you hang in there, and ensure callers that this system is here to stay, the noise level will diminish.

Future Possibilities

Currently, our phone system does not always detect that a caller has hung up. This causes the voice response unit to execute a time-out routine. This skews the statistics incorrectly, causes line congestion, and transfers calls with nobody holding on the line. To get around this situation, we developed a

"weak" routine to detect the situation when a caller is still on the line. When our telephone equipment software is updated to industry standards, this weak routine can be removed.

We plan to include a pager routine to page the support person or group when the mainframe is down or an excessive number of predefined circumstances occurs (unmatched or unrecognized screens).

All of the telephone lines used by the voice response unit were defined with call transfer. This causes a conference call mode to be set when transferring a call. This option needs to be removed, along with the code required to get around the conference calling option.

Many vendors call our office asking for basic information on how to get their invoices paid by the University. Another application would be to construct a series of instructions for callers to access to obtain basic information, for example; "Where do I send my invoice?"

Would We Do It Again?

The Accounts Payable and Travel Audit application has been on-line for more than a year. When asked if we would do it all again, the answer would be yes. That's not to say we haven't had problems. We have; some have already been mentioned! There are some things that we would do differently.

- We mentioned earlier that the vendor sent a representative to install the unit and do some in-house training BEFORE we had formal, intensive classroom training. This should have been reversed. We found ourselves scrambling to write a script of our application when we had very little background knowledge of the system itself. The week long training at the vendors home office provided us with enough information to have a much more thorough understanding of the system.

- One of the problems we mentioned earlier was trying to mold three applications from three different offices into one system. This was a mistake. We have recently split the applications onto three separate modules, but many problems could have been avoided if this been done in the beginning. The vendor recommended incorporating the applications into one; however, they didn't understand the "politics" that can occur at a university.

- At the same time we were working on the installation of the voice response unit within the Accounts Payable and Travel Audit Office, many other systems changes were being prepared. Our old system did not assign a

paydate when the invoice was initially audited. One of our system enhancements that came later was the paydate being assigned when the invoice went through the actual audit step. This change was not implemented until November, 1991. Remember, the Accounts Payable application on the voice response unit went "live" in September, 1991. We had two months of many calls being transferred to the service representatives when the invoice had been successfully audited but the voice response unit could not give a complete answer. Also, when our other changes were implemented in November, 1991, the learning curve proved to be quite steep and our office got behind which caused frustration on the part of callers because they had to wade through a new voice response unit only to find out that their invoice had not been processed. We should have waited for our new system to be implemented and for the office to be in a current status. We were too rushed to implement the voice response unit.

- The vendor emphasized the need for a system administrator, one person who would be assigned the responsibility to know the complete voice response unit system. We underestimated the need for this, especially since the unit was being shared by more than one university department. We now have an administrator for the unit who is responsible for making any necessary changes to the voice response unit itself. The departments who have an application then provide key individuals to write the script and provide technical assistance to the administrator. The administrator then goes in and programs the unit.

When the initial discussions took place about purchasing a voice response unit, we said we would be happy if the unit would be able to completely handle one-third of all the calls into the Accounts Payable and Travel Audit Office. Statistics show that the unit receives an average of 350-400 calls per day. Of these, 200 callers are transferred to the service representatives. This means that approximately 40 percent of all calls are being completely handled by the voice response unit.

The University of Michigan spent about $120,000 for this unit, including the in-house training and installation of the product. Remember, this unit is shared by four departments with four different applications, about $30,000 for each department. This is the cost of one service representative (including staff benefits) for one year. We think we made the right move!

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INFORMATION TECHNOLOGY: The Revolution Continues

FINANCIAL & ADMINISTRATIVE SYSTEMS

T2-3

Electronic Forms Processing at Boston College

John J. Springfield
Boston College

38th Annual
College and University
Computer Users Conference

Hosted by Baylor University
in San Antonio

May 9-12, 1993

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ELECTRONIC FORMS PROCESSING AT BOSTON COLLEGE

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What is Forms Processing?

We all know what a "form" is. Or do we? Most would probably agree that it's usually a pre-printed piece of paper that one must fill out in order to request something (for example, a credit card application). Or it can be an official notification from one office to another office (for example, a registrar notifying the housing office that a student has withdrawn from school).

But a "form" is more than a piece of paper. It is a process. It involves sending the form to appropriate individuals who will "approve" it. Once acted upon, it is important that the originator know the results of the request or notification. In some cases the form acts as an audit trail by requiring signatures and dates from various authorized individuals.

Forms processing has these components:

1) A pre-printed "form" that requires that information be supplied in a specific format by an authorized originator.

2) A method for sending or routing the "form" to authorized individuals for their acceptance or rejection.

3) A way to track the progress of the form so that all appropriate individuals can check the status of the form at various points in time.

The Problem with Paper Forms

Paper forms served us well in a society where time was measured in weeks instead of minutes, where communication was done via the postal service, and where the system assumed that some forms would be lost in the mail or inaccurately filled in.

But we now live in an age where every second counts, where we communicate via computer and fax machines, and where inaccuracy is less tolerated.

Electronic Forms - How They can Help

By using our computers instead of paper, we can mimic traditional forms processing as well as greatly improve the accuracy, timeliness, and routing of forms.

If we "paint" the traditional form on our computer screens, we can "edit" each required field as the originator enters the data. Unlike paper forms, we can catch errors before the form is sent.

Because we will send the form electronically, it will be delivered in seconds, not days.

People receiving the form can act more quickly on it because they know that the data has been checked before they receive it. Delays due to incomplete or inaccurate information are virtually eliminated.

An electronic audit trail is available so that the originator and all subsequent approvers can view the status of the form without having to make phone calls or send letters.

Since paper forms are no longer needed, there is no need to spend money to order, store, and distribute forms. No longer will there be horror stories about having to toss out boxes of forms because the format has slightly changed.

Originating an Electronic Form

At Boston College a form can be originated by any user of the administrative system (IBM CICS). A simple menu is presented:

```
                    INTER-OFFICE FORMS        DATE: MAY 1,1993
                                              NAME: J.DOE

SELECTION: _


              1  Originate a Form / View Available Forms

              2  View the Forms Originated by Our Department

              3  Approve the Forms Awaiting Our Attention

              4  View the Forms Previously Approved by Our Dept

              Q  Quit - Return to System Menu

              L  Logoff
```

After selecting option "1", the screen displays the various categories or forms that this user can originate:

```
              FORMS ORIGINATION MENU        DATE: MAY 1,1993
                                            NAME: J.DOE

ENTER CATEGORY NUMBER,
FORM NAME, OR "Q" TO QUIT: ________

                        1  ADMISSIONS
                        2  BUILDINGS AND GROUNDS
                        3  HUMAN RESOURCES
                        4  LIBRARY
                        5  REGISTRAR
                        6  STUDENT ACCOUNTS
                           etc.
```

After selecting option "5", the screen displays the registrar forms that this user is authorized to originate. It is important to note that some of the forms are "requests" from the registrar's office (available to a wide range of people), and others are "notifications" from the registrar's office (limited to registrar personnel). In this case, assume that the user is on the registrar's staff.

```
                ORIGINATE A FORM            DATE: MAY 1,1993
                   REGISTRAR                NAME: J.DOE

ENTER FORM NUMBER,
FORM NAME, OR "Q" TO QUIT: ________

         Num  Form      Description

          1   STADDR    CHANGE OF STUDENT ADDRESS
          2   STMAJOR   CHANGE OF STUDENT MAJOR
          3   STWITHDR  STUDENT WITHDRAWALS NOTIFICATION
              etc.
```

Option "3" is selected and the screen displays a form that allows the registrar to notify student accounts, housing, financial aid, and other departments that students have withdrawn from the university. Note that the ID number is the only required field that must be entered. All additional information is retrieved from the student file.

When this form is completed, it will automatically be sent to all of the destination departments.

```
------------------------------------------------------------

                Students Withdrawn From School

   ID       NAME             City         St  Zip    School
123456789 JONES,MARY       BOSTON       MA 02135   ARTS/SCIENCES
928776321 SMITH,THOMAS     NEW YORK     NY 10010   ARTS/SCIENCES
_________
_________
_________
_________
_________
_________

EFFECTIVE DATE: 05/01/1993

------------------------------------------------------------
```

Approving/Receiving an Electronic Form

Filled in forms are routed to departments. Based on security codes, only certain positions in the destination department can process the form.

An individual in a housing office position that has authority to process a form will see a list of "pending" forms when the option "APPROVE FORMS AWAITING OUR ATTENTION" is selected from the main menu:

```
------------------------------------------------------------

                 FORMS TO BE APPROVED        DATE: MAY 1,1993
                                             NAME: B.COOPER

Selection _ __ (A=Approve, V=View, P=Print, X=Cancel, Q=Quit)

                                Required   <-Last Processor Info-->
Num Form      Orig Date         Action     Status   Date       Process
 1  STWITHDR  05/01/1993        PRINT      ORIG    05/01/1993   J.DOE
 2  etc

------------------------------------------------------------
```

When "A 1" is selected, the form is flagged as approved and sent to further destinations (if any). Furthermore, the forms can be sent to a local printer or sent to an on-line transaction for further processing. In the above example, the form is sent to a printer.

System Design

The forms system runs on CICS using an IBM 3090. It has been designed so that all forms, routing, and security are table driven. In addition, utility programs have been developed for programmers to quickly "paint" new forms and associate edits with fields on the form.

All forms (screens) and associated edits are stored on a file when the form and its documentation is "checked in" by the programmer. Regardless of the number of forms developed, there is no need for further CICS transactions! All screen mapping and process logic is controlled by one basic transaction. Developing or changing forms is much faster than traditional programming.

Although not all possible edits can be performed on each input field, the edits are quite rich. Edits fall into these categories:

1) Basic Edits
   a) Automatic initialization of specified fields to date, time, username, etc.
   b) Check if field is required or optional
   c) Check for numerics, blanks, etc.
   d) Edit money with decimal places, signs
   e) Edit dates and times in various formats

2) Table Edits
   a) Compare a screen value to any of our online tables (containing valid codes and descriptions)
   b) Display description from online table

3) File Edits
   a) Ability to key any CICS file record and return any record field for display on screen.
   b) Ability to display fields based on logical "truth conditions"

4) Comparison edits
   a) Ability to compare the values of two input fields
   b) Ability to compare value of input field to the present date, time, and other system fields.

5) "Jump" Logic to Non-form Screens
   a) Ability to "jump" to another screen to retrieve data when user is unsure of values to enter.

Security and Routing Control

The Security administrator works closely with the programmer and the user to determine the security access to the forms and the routing to the various departments.

Security access is based on the same access codes we use for access to other CICS transactions. For example, there may be a security code for "Registrar - Updates". A form that can be processed by the same group of people will simply be assigned the same access code. However, a form can be further limited to specific positions, although it is usually not needed.

Each form can be routed through a maximum of nine departments. The form cannot proceed to the next level of approval until all departments on the same level have approved the form. A simple route can be one-to-one:

```
A --> B --> C --> D
```

Department B does not receive the form until Department A has approved it. Likewise, Department C must wait for Department B, and D must wait for C.

In some cases, a department wants to simply notify several departments all at once. Routing is one-to-many:

```
     B
    /
A  --C
    \
     D
```

In the above case, Department A routes the form to 3 different departments at the same time. Departments B, C, and D are not dependent on each other.

Combinations of one-to-one and one-to-many are permitted:

```
                  D
                 /
A --> B --> C --> F
             \
              E
```

In the above example, Departments D, E, and F all receive the form as soon as Department C approves it.

In the following routing scheme Department G must wait until Departments D, E, or F approves the form:

```
                 D
                / \
A --> B --> C ---> F --> G
                \ /
                 E
```

Impact of Electronic Forms on Workplace

When people started getting electronic mail, it started changing habits. People started "opening the mail" as part of their usual logon procedures.

Electronic forms have a similar effect. The list of pending forms acts as a "To Do" list of daily tasks. On most days there are not a lot of forms. But on the days where there are many pending forms of a different nature, the individual is able to quickly browse the list (much like scanning "mail") and determine which are most urgent.

The number of phone calls have been reduced. Since all parties can see the routing list with the approval dates and times, there is less of a need for frantic calls. On the other hand, "lost in the mail" is no longer an excuse.

Shortcuts used to be taken because everyone agreed that paper notification was too slow. But sometimes the after-the-fact notifications resulting from shortcuts resulted in wasted money and effort. If communication is fast and accurate, the need for shortcuts will be reduced.

Impact of Electronic Forms on Students

Although students have special "front ends" to access the administrative system, they too use electronic forms. One of the most popular is the change-of-address form. While students are using workstations to register themselves, they can choose a menu option that allows them to notify the college of a change of address or phone number.

Forms versus Direct Updates

Forms are not the answer to all inter-departmental communications. In some cases it may be appropriate to allow direct update of one department's data by another department. With tight enough edits it may be just as valid for the "other" department to do the updating without an "approval" from the owner department.

Conclusion

Electronic forms processing at Boston College has allowed inter-office information to be routed faster and more accurately than ever before. It has improved productivity of offices and improved the service that we can offer students, faculty, and staff.

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INFORMATION TECHNOLOGY: The Revolution Continues

FINANCIAL & ADMINISTRATIVE SYSTEMS

T4-3

Financial Management Information Solutions at Clemson University

Steve Crump
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FINANCIAL MANAGEMENT INFORMATION SOLUTIONS AT CLEMSON UNIVERSITY

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Background

Clemson University is an institution of higher education established by the citizens of South Carolina to preserve, enhance, interpret, and disseminate the body of human knowledge. As a publicly-assisted, comprehensive land-grant institution, Clemson serves the state, the nation as a whole, and the international community through teaching research, and public service activities.

To fulfill its mission, Clemson offers undergraduate and graduate programs within nine colleges and a graduate school to a diversified on-campus student body and to a variety of audiences through continuing education courses on and off campus. The institution's role within the State of South Carolina is fulfilled through its mandated thrusts in agriculture and natural resources, architecture, engineering, textiles, basic sciences and technologies and through an expanded role which also addresses the state's cultural and economic needs through emphasis in health services, business, education, and the liberal arts. Clemson University's response to public services is reflected through the expertise of each of nine colleges, the S.C. Agricultural Experiment Station, the Clemson University Cooperative Extension Service, and numerous regulatory programs which provide technical assistance, continuing education, technology transfer, and extension activities commensurate with life in a changing world and global society.

Clemson University is located in the northwestern corner of South Carolina. The campus proper consists of 1,400 acres surrounded by 18,000 acres of University farms and woodlands devoted to research. Approximately two-thirds of these across the state are devoted to agriculture extension and 4-H work. Graduate and undergraduate enrollment for the University is approximately 16,000. These students are supported by slightly over 4000 full-time faculty and staff, and an annual budget of $300 million.

The growth and diversity of the University, as well as changing authoritative accounting standards, state and federal reporting and operating requirements, and the increasing competitiveness for students and research dollars are some of the drivers of the new information needs at Clemson.

Financial System Environment

The current University administrative systems were developed in-house about 15 years ago. They are maintained by a centralized team of programmers, analysts and database and security administrators. The accounting system is one facet of the whole package. The original system requirements were developed in conjunction with University accounting and budget office personnel based on their definitions of needs and the existing reporting environment.

The cornerstone of the system is a seventeen digit account number with some intelligence included. Six individual fields with varying lengths comprise this number (Exhibit A). A general ledger module posts detail and summary transactions to these accounts. Other modules such as payroll and a vendor check processor feed the central module. Posting occurs after a nightly process run in batch mode.

Originally, standardized reports formats were defined by the users and were produced by production jobs run at the central data center on a monthly basis. These reports were available primarily to the central administration. Since 1975, many enhancements have been made in all modules. Some of these include

- expanding on-line access of information to end-users, both for on-line query and on-line report requests
- allowing on-line update of information by the departmental users with real-time, not batch update
- processing documents via electronic forms with on-line approvals.

Management Information Solutions

Facing the changing information requirements of users, Clemson began some years ago to search for a workable solution. A system study done in conjunction with a major vendor sought to outline users' needs. This was the springboard for a later system analysis which led to the development of a detailed request for proposal. This request resulted in several vendor presentations of overall accounting system packages. However, with no one vendor offering a total solution, and with anticipated reductions in State funding, the option to purchase new software and hardware was not feasible. The alternative option of totally redesigning the existing system was not selected due to currently limited internal programming resources.

The next best alternative was to find a solution which could affordably meet reporting needs in as timely a manner as possible. Research continued to be done on what other colleges and universities were using to meet their needs. Clemson was operating on the theory that college and university operations and reporting were so unique that only a solution made for higher education could work. This premise was proven wrong when university personnel were introduced to a PC based reporting software solution developed by IMRS. Their products are currently used to meet reporting needs of many Fortune 500 companies. The basic reporting requirements for Clemson, even though they appear to be different, are basically the same as any large business operation. Common needs include the ability

- to report in a timely manner

- to report in various formats defined by the user in a "friendly" environment
- to adjust the data for proposed changes in "what-if" scenarios
- to report at various levels within the organization and be able to "drill-down" to desired levels of detail
- to report in multiple organizational structures without repeating the same core data.

As the IMRS software had successfully addressed these same issues in the corporate arena, Clemson made the commitment to purchase management information reporting software. This action was seen as a way to increase user satisfaction and productivity with less of a financial commitment than a total system overhaul, less drain on mainframe programming resources, and less disruption to normal processing and work schedules.

The IMRS company markets component products which meet the University's needs. The database piece houses all the information in the appropriately user defined reporting relationships which forms the core of the system. Regular printed reports are created in this software and the on-line query and display features of the product reside here. An executive information system (EIS) piece draws the information from the database and presents it in standard chart or graphical formats.

The database piece is called Micro Control. This is where the flexibility and reporting functionality lie. The design of the reporting relationships and definition of detailed data are critical to allow information extraction later. It is DOS based. The EIS piece, On-Track, is Windows based and provides the GUI features that many users have come to expect.

Solution Implementation

Clemson began a phased implementation of the products by choosing one application to design and have functioning in a relatively short period of time. A critical need of the University was to be able to produce financial statements in a timely manner. Therefore, phase one of the IMRS implementation was to produce financial statements for Clemson University by June 30, 1992. The project began January, 1992. This phase included

- design of the organizational structure (Exhibit B)
- definition of the chart of accounts (Exhibit C)
- coordination of the move of data from mainframe to PC
- configuration of network and PC hardware
- creation of specific financial reports (Exhibit D).

The implementation team for Micro Control was really a triumvirate. A three person Administrative Programming group who maintain the mainframe general ledger system, a three person network administration group in the Business and Finance area who maintain network and PC systems, and a four person financial group with experience in the mainframe application system and the financial reporting requirements. Cooperation and coordination between these groups was essential to the successful implementation of the product.

Three of the financial group attended a week of vendor training to learn the details of Micro Control. Then, meeting with consultants from the vendor, the initial structures and chart of accounts were defined. Software was loaded onto the network and prototyping the system began.

The source of all the information for Micro Control is the existing mainframe general ledger. It runs on a large Hitachi mainframe which is centrally maintained by the University's Division of Computing and Information Technology (DCIT). Micro Control itself runs on a Novell network. All data and program files are loaded onto a separate drive and use approximately 60 megabytes of space. 386 and 486 PCs have both been used to operate Micro Control with satisfactory performance results.

Each night, after batch posting of the general ledger occurs on the mainframe, an extract of all data is created by production jobs. This is the file that is vital to Micro Control.

A set of conversion tables was created by the financial group which defines the relationship of the mainframe system account number to the Micro Control account and component. COBOL programs, written by the administrative programming group, call these tables, apply them to the nightly extract file and produce a dataset in the correct format for Micro Control to read and load into its database. Conversion takes place on the mainframe side to take advantage of the processing power there. Over one million records are on the extract file by the end of the fiscal year. These are all read and condensed from approximately 300,000 accounts to approximately 1200 accounts on the PC software.

The following sequence of events takes place to move the data from mainframe to PC:

During overnight processing as part of regular production job stream

- mainframe financial system posts transactions
- mainframe extract file is created
- conversion programs run and create mainframe dataset in Micro Control file format.

In the morning in the Accounting office

- Micro Control file is checked for comparability with mainframe data (e.g.. has all account maintenance done on mainframe side been reflected on PC side) and any corrections to the PC side are made
- file is downloaded to Novell network

- file is loaded into the correct time period and category (i.e. Actual or Budget, etc.) in Micro Control

- a consolidation process is started in Micro Control to summarize the appropriately defined sub-totals

- reports are printed and data is available on-line for inquiry.

At this point, the cycle is complete from the standpoint of movement of data. Now the end-user can began to use the information on-line, request standard reports, such as the financial statements, which have been pre-defined, or using the Micro Control report builder, create their own reports.

For more flexible and dramatic presentation formats, the EIS piece is the appropriate vehicle. Files in On-Track reference account numbers in the database and the values of these accounts are then presented on-screen. As new information is updated in the database it is reflected in the on-screen presentation. On-Track gives the user the capability of moving from a total figure on the screen to multiple lower levels that compile the figure. Numbers can be graphed and notes and accompanying information can be inserted onto the screens for the user's edification. All movement between screens is mouse driven.

The technical operations of the mainframe and PC systems were synchronized and the test financial statement were produced by May, 1992. Significant testing then followed to ensure the accuracy of the data.

Implementation Results

Immediately upon the closing of the books for the 1992 fiscal year, Micro Control produced financial statements for the University and phase one ended successfully. The essential GAAP (generally accepted accounting principles) financial statements for colleges and universities are : the Balance Sheet, the Statement of Changes in Fund Balances, and the Statement of Current Funds Revenues, Expenditures and Other Changes. Previously, utilizing only the University's existing general ledger, these basic statements took upwards of six weeks to compile. Data had to be summarized considerably, and was often reformatted in order to produce these statements. It was an intensive, hands-on manual operation requiring piece-meal downloads from the mainframe, manipulation of the data utilizing commercial spreadsheet packages to produce trial balances, and re-keying of this data into final product financial statement format. Besides the obvious time and effort drawbacks inherent in this process, it was extremely inflexible; posting audit adjustments or reformatting the statements for other reporting entities was a massive undertaking. Basically, a change request required financial reporting personnel to repeat the original arduous process.

Also, immediately available were alternate and subsidiary reports developed for other reporting entities. The Statement of Changes in Unrestricted Fund Balances (Exhibit D, Page 2), for example, segmented information from the Statement of Current Funds Revenues, Expenditures and Other Changes into Basic Educational and General, Auxiliary and Agricultural Public Service Components. Thus, the University had across-the-board financial reporting capability at the earliest possible date.

In addition to producing "instant" year-end financial statements, the University realized other tangible benefits from the information solution.

The relative ease and flexibility in downloading comprehensive data from the mainframe, for the first time, makes it possible to issue interim financial reports. Financial data is downloaded on a weekly, and sometimes even, daily basis, to provide administrators and managers up-to-the-minute performance information.

The new database also allows for more sophisticated reporting in the endowment and plant funds. The University's general ledger design did not anticipate the need for the multiple funds existing in today's accounting environment. Consequently, the Permanent, Quasi and Term Endowment Funds are all rolled into one fund group in the general ledger. Likewise for plant funds, Unexpended, Renewals and Replacements, Retirement of Indebtedness and Investment in Plant funds are grouped as one. These individual funds are restricted in nature and are required by GAAP to be accounted for separately. The Micro Control database literally splits the existing general ledger "holding funds" into the proper categories. The result is a Statement of Change in Fund Balances and a Balance Sheet for each of the separate funds.

This enhanced financial reporting capability has served University administration well thus far. However, it is also bringing to the forefront some quality issues and causing a reassessment of some financial strategies.

For example, Clemson is increasingly focusing its efforts in research initiatives. The majority of research grants at the University operate on a cost reimbursement basis (e.g. the research is done and expenses made, then Clemson bills the sponsor and receives payment after the fact). The ability to examine sponsored program cash balances weekly, or even daily, on an aggregate basis instead of project by project led to better cash management practices. These included more aggressive collections procedures, negotiating scheduled payment contracts and increased use of electronic funds transfer.

Also, it has forced a look at the traditional annual reporting cycle. Many University-wide charges, such as internal computer usage or general and administrative charges assessed on campus profit centers were formerly recorded in lump-sum once a year. State appropriations, usually in excess of $100 million were recorded in a similar manner. With the advent of University level interim financial statements, these once a year entries proved distorting. The result has been to book these items on a pro-rated or per-capita basis, thereby providing more meaningful information to administration.

Overall, phase one of the implementation has proven imminently successful. The desired short-term goal, production of the University GAAP and other year-end financial statements was met. In addition, interim financial statements, and other reports developed since have resulted in increased efficiencies and improvements in meeting the planning and fiduciary responsibilities of the University.

Future Goals

With the integrity and accuracy of the Micro Control database firmly established, repeated requests for detailed, specialized reporting are being received. The Office of the Provost has requested summary financial reports which accumulate data for all academic departments. The Public Service Division plans bi-weekly reporting for budget monitoring and reporting based on the Federal fiscal year which differs from that of the University.

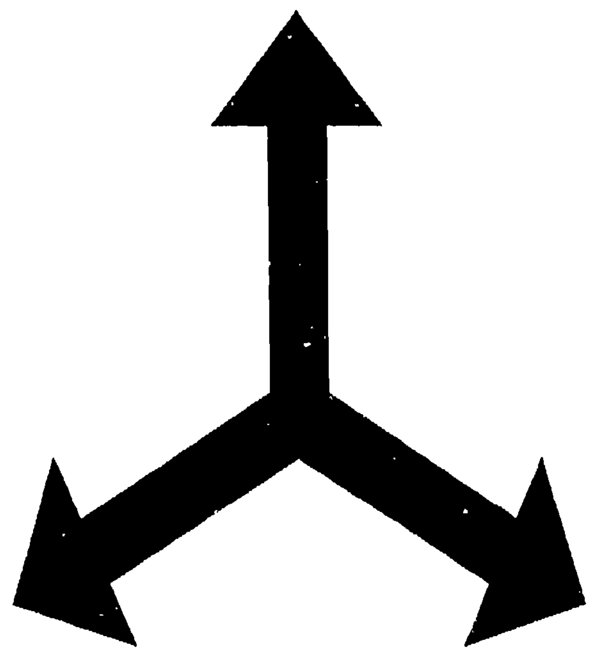
Considerable attention has been given to each of these requests as well as other aspects for the future. Broadening the on-line access to Micro Control and On-Track is essential in the continued success of the implementation. This will require end-user training and education so that the full potential of the available information can be realized. The immediate goal of the implementation team is to incorporate budget information into the existing database which is populated with actual figures. This will provide the ability to provide traditional budget vs. actual type management information; in the current budget environment this should prove particularly helpful.

Summary

Clemson is quite pleased with the solution it has implemented to meet some of its management information challenges. A purchased package which feeds on the massive data and processing power of the mainframe is serving us well, and has great potential for future applications. Surely, this will not be the final solution for providing management information; daily, needs change and new technologies and products bring more power closer to the end-user. Regardless of the mechanism, getting the information into the hands of those who make the decisions is the ultimate solution.

EXHIBIT A

AIS ACCOUNT NUMBER
1-20-6315-0501-51-0000



MICRO►CONTROL
COMPONENT
N0501

MICRO►CONTROL
ACCOUNT
NUMBER
31065.100

206

2

EXHIBIT B

Micro Control 3.5

- GAAP — GAAP REPORTING
  - CURRNT — CURRENT FUNDS
    - CURUN — CURRENT UNRESTRICTED FUNDS
      - EGUN — EDUCATIONAL AND GENERAL FUNDS
        - GENERL — GENERAL
          - BALGEN — E&G REPORTING
          - GENST — GENERAL - STATE
            - GENST1 — GENERAL - STATE
              - N0501 — Dean of Architecture
              - N0503 — Architectural Studies
              - N0507 — Building Sciences
              - N0509 — Visual Arts and History
              - N0511 — Planning Studies
              - N0590 — Centers for Arch. Studies
              - N0701 — Dean of Education
              - N0702 — Associate Dean of Education
              - N0703 — Military Science
              - N0705 — Aerospace Studies
              - N0709 — Elem and Secondary Ed
              - N0711 — Industrial Ed
              - N0901 — Dean of Engineering

```
!********************************************** !!*****************************************************************!
!                                               !!                                                                 !
.    CHART OF ACCTS (CLEMSON UNIVERSITY)        !!      HEADINGS FILE                                              !
!    DATE: 7/29/92                              !!                                                                 !
!                                               !!                                                   EXHIBIT C     !
!********************************************** !!*****************************************************************!
OPTION ALPHA                                    !!
GROUP 1 !*** NON-FINANCIAL ***                  !!GROUP 1 **** NON-FINANCIAL ***                                   !
!********************************************** !!*****************************************************************!
                                                !!                                                                 !
                                                !!JOURNAL ENTRY ACCOUNTS                                           !
                                                !!                                                                 !
ACC=A1111                                       !A1111  "JE FG1"                                                   !
ACC=A2222                                       !A2222  "JE FG2"                                                   !
ACC=A3333                                       !A3333  "JE FG3"                                                   !
ACC=A4444                                       !A4444  "JE FG4"                                                   !
ACC=A5555                                       !A5555  "JE FG5"                                                   !
ACC=A6666                                       !A6666  "JE FG6"                                                   !
ACC=A777P                                       !A777P  "JE FG7P"                                                  !
ACC=A777Q                                       !A777Q  "JE FG7Q"                                                  !
ACC=A777T                                       !A777T  "JE FG7T"                                                  !
ACC=A8ROI                                       !A8ROI  "JE FG8ROI"                                                !
ACC=A88RR                                       !A88RR  "JE FG8RR"                                                 !
ACC=A8UNX                                       !A8UNX  "JE FG8UNX"                                                !
ACC=A8INV                                       !A8INV  "JE FG8INV"                                                !
                                                !!                                                                 !
                                                !!         INVENTORY ACCOUNT-AUXILIARIES                           !
                                                !!                                                                 !
ACC=BINV2                                       !BINV2     "BEGINNING INVENTORY"                                   !
!                                               !!                                                                 !
!********************************************** !!*****************************************************************!
GROUP 2 !*** STATEMENT OF REV, EXP, OTHER CHG   !!GROUP 2 **** STATEMENT OF REV, EXP, OTHER CHG                    !
!********************************************** !!*****************************************************************!
                                                !!                                                                 !
                                                !!         REVENUES AND OTHER ADDITIONS:                           !
                                                !!                                                                 !
ACC=20010                                       !20010     "STUDENT FEES"                                          !
  SUB=10,20,30,40,50,98                         !20010.10  "Academic Fees"                                         !
                                                !20010.20  "Summer School Fees"                                    !
                                                !20010.30  "Laboratory Fees"                                       !
                                                !20010.40  "Short Courses and Seminars"                            !
                                                !20010.50  "Other Student Fees"                                    !
                                                !20010.98  "Holding"                                               !
                                                !!                                                                 !
ACC=20020                                       !20020     "FEDERAL APPROPRIATIONS"                                !
                                                !!                                                                 !
ACC=20030                                       !20030     "STATE AND LOCAL APP"                                   !
                                                !!                                                                 !
ACC=20040                                       !20040     "FEDERAL GRANTS AND CONTRACTS"                          !
  SUB=10,20,98                                  !20040.10  "Federal Grants and Contracts"                          !
                                                !20040.20  "Indirect Cost Recoveries"                              !
                                                !20040.98  "Holding"                                               !
                                                !!                                                                 !
ACC=20050                                       !20050     "STATE GRANTS AND CONTRACTS"                            !
  SUB=10,20,98                                  !20050.10  "State Grants and Contracts"                            !
                                                !20050.20  "Indirect Cost Recoveries"                              !
                                                !20050.98  "Holding"                                               !
                                                !!                                                                 !
ACC=20060                                       !20060     "LOCAL GRANTS AND CONTRACTS"                            !
  SUB=10,20,98                                  !20060.10  "Local Grants and Contracts"                            !
```

CLEMSON UNIVERSITY
BALANCE SHEET- UNRESTRICTED CURRENT FUNDS
YEAR ENDED JUN/92 Page: 1

	ASSETS		LIABIALITIES AND FUND BALANCES
Cash and cash equivalents	2,206,125	Accounts payable	233,468
Accounts receivable	1,081,225	Accrued liabilities	2,197,970
Inventories	562,953	Deferred revenues	2,307,370
Prepaid expenses	2,129,912	Student deposits	360,007
Due from restricted current funds	-	Accrued vacation	-
		Fund balance (deficit)	881,399
TOTAL E&G	5,980,215	TOTAL E&G	5,980,215
Cash and cash equivalents	-	Accounts payable	-
		Accrued liabilities	-
TOTAL CLEARING	-	TOTAL CLEARING	-
TOTAL	5,980,215	TOTAL	5,980,215
Cash and cash equivalents	200,075	Accounts payable	66,526
Federal G&C Receivable	1,088,689	Accrued liabilities	1,241,649
Accounts receivable	-	Deferred revenues	1,652
Inventories	-	Student deposits	9,199
Prepaid expenses	30,261	Accrued vacation	-
Due from restricted current funds	-	Fund balance (deficit)	-
TOTAL PSA	1,319,025	TOTAL PSA	1,319,025
Cash and cash equivalents	15,427,779	Accounts payable	656,763
Accounts receivable	1,446,460	Accrued liabilites	429,844
Inventories	2,560,667	Deferred revenues	6,184,668
Prepaid expenses	334,758	Student deposits	898,709
Due from restricted current funds	26,329	Accrued vacation	-
		Due to other funds	26,329
		Fund balance (deficit)	11,599,680
TOTAL AUXILIARIES	19,795,993	TOTAL AUXILIARIES	19,795,993
TOTAL	27,095,233	TOTAL	27,095,233

CLEMSON UNIVERSITY
STATEMENT OF CHANGES IN UNRESTRICTED FUND BALANCES
YEAREND JUN/92

	BASIC EDUCATIONAL AND GENERAL	AUXILIARIES	AGRICULTURAL RESEARCH	COOPERATIVE AGRICULTURAL EXTENSION	FOREST AND RECREATION RESOURCES
REVENUES:					
Student fees	57,186,931	-	-	-	-
Federal appropriations	25,000	-	3,624,151	7,942,894	376,275
State and local appropriations	76,358,527	-	15,326,925	19,063,852	2,843,719
Federal grants and contracts	3,125,707	-	-	-	-
State grants and contracts	18,797	-	-	-	-
Local grants and contracts	1,467	-	-	-	-
Private gifts, grants and contracts	990,467	-	-	-	-
Endowment income	9,266	-	-	-	-
Sales/services of educational departments	70,145	-	686,512	729,520	313,798
Sales and services of auxiliary enterprise	-	60,307,381	-	-	-
Computer and systems developement	5,005,575	-	-	-	-
Other sources	3,477,536	-	3,264	787	5,112
TOTAL UNRESTRICTED CURRENT REVENUES	146,269,418	60,307,381	19,640,851	27,737,053	3,538,904
EXPENDITURES AND MANDATORY TRANSFERS:					
Educational and general:					
Instruction	63,391,891	-	-	-	-
Research	11,331,529	-	15,267,008	-	2,447,626
Public service	3,420,368	-	-	26,430,222	468,700
Academic support	16,250,279	-	-	-	339,783
Student services	6,847,274	-	-	-	-
Institutional support	15,013,189	-	-	-	-
Operation and maintenance of plant	15,921,697	-	-	-	-
Scholarships and fellowships	917,042	-	-	-	-
Departmental administration expense	13,751,836	-	3,845,746	1,874,982	502,974
TOTAL UNRESTRICTED E & G EXPENDITURES	146,845,105	-	19,112,754	28,305,204	3,759,083
Mandatory transfers for:					
Principal and interest	-	-	-	-	-
Loan fund matching grants	24,878	-	-	-	-
TOTAL MANDATORY TRANSFERS	24,878	-	-	-	-
TOTAL EDUCATIONAL AND GENERAL	146,869,983	-	19,112,754	28,305,204	3,759,083
Auxiliary Enterprises:					
Expenditures	-	54,996,734	-	-	-
Mandatory transfers for:					
Principal and interest	-	2,857,456	-	-	-
Renewals and replacements	-	-	-	-	-
TOTAL AUXILIARY ENTERPRISES	-	57,854,190	-	-	-
TOTAL EXPENDITURES AND MANDATORY TRANSFERS	146,869,983	57,854,190	19,112,754	28,305,204	3,759,083
OTHER TRANSFERS AND ADDITIONS/(DEDUCTIONS):					
Indirect costs recovered	-	-	-	-	-
Indirect costs remitted to state	(213,282)	-	-	-	-
Non-mandatory transfers-unrestricted	(313,099)	57,888	-	924,413	-
Net transfers between funds	-	-	-	-	-
Realized investment losses & other costs	-	-	-	-	-
TOTAL OTHER TRANSFERS AND ADDITIONS/(DEDUCTIONS)	(526,381)	57,888	-	924,413	-
NET INCREASE (DECREASE) IN FUND BALANCE	(1,126,947)	2,511,079	528,098	356,262	(220,179)
Fund Balance at Beginning of Year	2,008,346	9,088,601	1,402,691	(2,020,828)	(1,718)
Prior Period Adjustment	-	-	-	-	-
FUND BALANCE AT END OF YEAR	881,399	11,599,680	1,930,788	(1,664,566)	(221,897)

CLEMSON UNIVERSITY
STATEMENT OF CHANGES IN UNRESTRICTED FUND BALANCES
YEAREND JUN/92

	REGULATORY SERVICES	LIVESTOCK POULTRY HEALTH	STATE ENERGY PROGRAM	BIOENGINEERING	OTHER PUBLIC SERVICE
REVENUES:					
Student fees	-	-	-	-	-
Federal appropriations	-	-	-	-	-
State and local appropriations	2,074,891	2,351,486	114,132	144,323	-
Federal grants and contracts	83,841	137,814	-	-	-
State grants and contracts	-	-	-	-	-
Local grants and contracts	-	-	-	-	-
Private gifts, grants and contracts	-	-	-	-	-
Endowment income	-	-	-	-	-
Sales/services of educational departments	50,000	141,924	-	-	-
Sales and services of auxiliary enterprise	-	-	-	-	-
Computer and systems developement	-	-	-	-	-
Other sources	75	-	-	-	-
TOTAL UNRESTRICTED CURRENT REVENUES	2,208,807	2,631,224	114,132	144,323	-
EXPENDITURES AND MANDATORY TRANSFERS:					
Educational and general:					
Instruction	-	-	-	-	-
Research	-	-	49,992	146,266	-
Public service	1,668,804	2,303,216	-	-	-
Academic support	-	-	-	-	-
Student services	-	-	-	-	-
Institutional support	-	-	-	-	-
Operation and maintenance of plant	-	-	-	-	-
Scholarships and fellowships	-	-	-	-	-
Departmental administration expense	479,186	297,743	68,360	-	-
TOTAL UNRESTRICTED E & G EXPENDITURES	2,147,990	2,600,960	118,352	146,266	-
Mandatory transfers for:					
Principal and interest	-	-	-	-	-
Loan fund matching grants	-	-	-	-	-
TOTAL MANDATORY TRANSFERS	-	-	-	-	-
TOTAL EDUCATIONAL AND GENERAL	2,147,990	2,600,960	118,352	146,266	-
Auxiliary Enterprises:					
Experditures	-	-	-	-	-
Mandatory transfers for:					
Principal and interest	-	-	-	-	-
Renewals and replacements	-	-	-	-	-
TOTAL AUXILIARY ENTERPRISES	-	-	-	-	-
TOTAL EXPENDITURES AND MANDATORY TRANSFERS	2,147,990	2,600,960	118,352	146,266	-
OTHER TRANSFERS AND ADDITIONS/(DEDUCTIONS):					
Indirect costs recovered	-	-	-	-	-
Indirect costs remitted to state	(85,928)	(137,814)	-	-	-
Non-mandatory transfers-unrestricted	-	-	-	-	-
Net transfers between funds	-	-	-	-	-
Realized investment losses & other costs	-	-	-	-	-
TOTAL OTHER TRANSFERS AND ADDITIONS/(DEDUCTIONS)	(85,928)	(137,814)	-	-	-
NET INCREASE (DECREASE) IN FUND BALANCE	(25,111)	(107,550)	(4,220)	(1,943)	-
Fund Balance at Beginning of Year	37,158	42,308	2,187	12,845	-
Prior Period Adjustment	-	-	-	-	-
FUND BALANCE AT END OF YEAR	12,047	(65,242)	(2,032)	10,902	-

CLEMSON UNIVERSITY
STATEMENT OF CHANGES IN UNRESTRICTED FUND BALANCES
YEAREND JUN/92 Page: 4

	TOTAL
REVENUES:	
Student fees	57,186,931
Federal appropriations	11,968,320
State and local appropriations	118,277,855
Federal grants and contracts	3,347,362
State grants and contracts	18,797
Local grants and contracts	1,467
Private gifts, grants and contracts	990,467
Endowment income	9,266
Sales/services of educational departments	1,991,898
Sales and services of auxiliary enterprise	60,307,381
Computer and systems developement	5,005,575
Other sources	3,486,774
TOTAL UNRESTRICTED CURRENT REVENUES	262,592,093
EXPENDITURES AND MANDATORY TRANSFERS:	
Educational and general:	
Instruction	63,391,891
Research	29,242,422
Public service	34,291,310
Academic support	16,590,062
Student services	6,847,274
Institutional support	15,013,189
Operation and maintenance of plant	15,921,697
Scholarships and fellowships	917,042
Departmental administration expense	20,820,826
TOTAL UNRESTRICTED E & G EXPENDITURES	203,035,713
Mandatory transfers for:	
Principal and interest	-
Loan fund matching grants	24,878
TOTAL MANDATORY TRANSFERS	24,878
TOTAL EDUCATIONAL AND GENERAL	203,060,591
Auxiliary Enterprises:	
Expenditures	54,996,734
Mandatory transfers for:	
Principal and interest	2,857,456
Renewals and replacements	-
TOTAL AUXILIARY ENTERPRISES	57,854,190
TOTAL EXPENDITURES AND MANDATORY TRANSFERS	260,914,781
OTHER TRANSFERS AND ADDITIONS/(DEDUCTIONS):	
Indirect costs recovered	-
Indirect costs remitted to state	(437,024)
Non-mandatory transfers-unrestricted	669,201
Net transfers between funds	-
Realized investment losses & other costs	-
TOTAL OTHER TRANSFERS AND ADDITIONS/(DEDUCTIONS)	232,177
NET INCREASE (DECREASE) IN FUND BALANCE	1,909,489
Fund Balance at Beginning of Year	10,571,590
Prior Period Adjustment	-
FUND BALANCE AT END OF YEAR	12,481,079

CUMREC
BAYLOR UNIVERSITY '93
San Antonio

INFORMATION TECHNOLOGY: The Revolution Continues

FINANCIAL & ADMINISTRATIVE SYSTEMS

W1-3

So You Want to Write a CUMREC Paper? Tips for Planning and Presenting

Normandy Roden
University of Wisconsin-Madison

38th Annual
College and University
Computer Users Conference

Hosted by Baylor University
in San Antonio

May 9–12, 1993

214

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By:

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So You Want to Write a CUMREC Paper?

Tips for Planning and Presenting

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Introduction

Why write a CUMREC paper? For many CUMREC conference-goers, writing and presenting a paper is the natural outgrowth of having attended prior conferences. Learning about the experiences of other people at other institutions encourages them to want to share their own success stories at the next year's conference. Other presenters, when they first plan to attend the conference, immediately consider whether or not their current or recent projects would lend themselves to such a forum.

From a broader perspective, writing and presenting a paper can be personally rewarding, as well as professionally stimulating. Writing and presenting is a way of paying back a debt . . . a learning experience in and of itself. *"There is a strong personal satisfaction in knowing that your shared information helps others in the field do their jobs better."* (Gerald W. McLaughlin and Julia A. Rudy, workshop on writing for CAUSE/EFFECT, 1991 CAUSE Conference.)

The goal of this paper is to encourage you, the reader, to become the writer/presenter. By sharing information about the CUMREC presentation process, by explaining the relevant timeframes, responsibilities, and expectations, the author hopes to enhance the likelihood of future participation in this process by conference attendees.

Background: First, Understand Your Audience

For whom are you writing? CUMREC is the oldest professional association in the United States devoted to computing in higher education. Currently hosting its 38th annual conference, CUMREC was formed in 1956 as the College and University Machine Records Conference (hence, the acronym CUMREC) and was organized by administrative computing staff at Michigan State University. The name was changed -- to the more current College and University Computer Users Conference -- by the conference board in 1988, although the familiar acronym CUMREC was retained.

One of the primary goals of CUMREC is to provide individuals in higher education with the opportunity to share information on computerized information systems, with a special focus on student and financial systems. In addition, several other issues relating to administrative computing have become the subjects of much interest; these include: data management and managerial responsibilities, security, conversions to new technologies, and sensitivity to end-users.

First Thoughts: Submitting the 'Intent to Present'

You think you would like to submit a paper for presentation at the next year's CUMREC Conference . . . what do you do?

Each summer, the host committee for the next year's conference coordinates a Call for Papers. The Call is distributed with the July edition of the quarterly CUMREC Newsletter to persons on the current CUMREC mailing list -- i.e., persons who have attended at least one conference within the previous three years. Information on the Call for Papers is also made available to other relevant professional associations.

Responding to the Call for Papers is a simple process. The interested person completes an Intent to Present card (see Appendix A) -- this card is also included in the July Newsletter. The only information requested at this time is the general topic of the proposed paper and the author's name, institution, and address. The Intent to Present card is due at the host committee office by the end of September, in the fall preceding the spring conference.

What does it mean to submit an Intent to Present? What happens next? Submission of an Intent to Present is not a promise to submit an actual paper -- it simply indicates interest. The host committee responds to all persons submitting Intents, sending them: acknowledgment of receipt of the Intent; guidelines for preparing written copy; and the deadline for submitting the paper. The paper submission deadline generally falls in mid-November.

The Importance of the Written Word: Developing a Paper

How do you translate a good idea into a good paper? As you go about the business of putting your thoughts down on paper, there are a number of points to consider: Is the discussion relevant? Is it clear to someone outside my institution? Does it make sense to someone outside my field?

When you have a draft copy ready, it's always a good plan to ask at least two other people to read it: one person who is close to the project or subject you describe -- to see if you left anything out; one person who isn't -- to tell you if it all makes sense. Remember the rules of standard prose (refer to the Chicago *Manual of Style* if in doubt). The most common writing pitfalls are incorrect or missing punctuation; inconsistencies in tense; incorrect spelling; and basic errors in grammar (noun-verb don't agree, etc.). Other problem areas also exist -- for example, gender specific language and use of unidentified acronyms.

Remember to follow the guidelines for written copy sent to you by the host committee! These include both specifications of format and margin widths and length limitations. If your paper is accepted, you will find it far easier to submit final camera ready copy if your initial text already conforms to the guidelines of the committee.

Now, What Does the Committee Think?

What do THEY do? The Program Committee for the given year's conference is responsible for reviewing and selecting the papers for the conference, for determining the program tracks that will be presented, and for assigning each accepted paper into the appropriate program track. The committee has six members: the Vice President of the CUMREC Board, the current year's local program chair, the next year's local program chair, and three at-large members (selected according to interest, as demonstrated in the interest sheets available to conference attendees each year). The committee members receive a packet of papers to read in early December and have about four weeks to read and rate them. In early January, the committee members join other committee and Board members at the conference hotel site, where they compare evaluations and make the final selection.

Each paper is read by three Program Committee members. Each member also scores the paper according to a previously agreed upon scale -- the average of these scores, along with the evaluations of the oral presentations, determines the top papers of the conference. In addition to identifying the papers accepted for presentation, the committee identifies several alternates -- papers which will be included in the published *Proceedings* and which will be presented at the conference in the event of a cancellation by an accepted paper.

As appropriate, committee members note editorial and other suggestions on the accepted and alternate papers. These suggestions and/or corrections are conveyed to the author(s) after the program review meeting, in a letter sent out around the third week of January.

Your paper was accepted or selected as an alternate -- what do you do? Authors of accepted and alternate papers should note the comments (if any) of the committee members and revise their papers accordingly. Technical corrections and other updates, based upon feedback from others who have read the paper, can also be made at this time but remember: you should not be making substantial changes <u>after</u> committee review.

Your paper was rejected -- now what? Whatever you do, don't give up! Perhaps your topic was not particularly relevant to the CUMREC conference, but might be better suited to a different audience. Perhaps grammatical and other editorial problems derailed your paper's progress through committee. Or perhaps there were a number of papers submitted on a single or similar topics that year, and not all could be accepted. The best advice? -- Consider any comments made by the committee, ask questions if you don't understand, and ask for input to improve: it may be appropriate to try again next year!

Polishing the Written Word: Finalizing Your Paper

You've noted the updates and suggested revisions of the committee -- now what does the committee need from you? Notification of acceptance is sent in mid-late January. The committee will indicate the deadline (generally around mid-February) for the submission of several critical items:

-- the final, camera ready paper (for publication in the Conference *Proceedings*);

-- a 100-150 word abstract, or summary, of the paper (for publication in the pocket conference brochure guide);

-- a listing of any audiovisual requirements for the presentation (if your needs are not simple -- e.g., overheads, slide projectors, videotape recorders -- you may need to speak directly with the local conference staff to verify that those needs can be met, and/or arrange to bring your own equipment); and,

-- brief biographical information on the person or persons who will be presenting the paper at the conference. The latter information is used by the moderator of the session to introduce the speaker(s) to the audience.

Anything else you should be doing at this time? Yes -- let the appropriate people on your campus know that your paper has been accepted -- this is an honor!

When is Silence Golden? Preparing an Oral Presentation

How do you translate the written word into the spoken? Ask yourself the following: What does the audience need to hear? What portions of the written paper should be included in the oral presentation? What additional information should be added? (This is your time to incorporate any recent, relevant developments.) What portions of the written text should be left out?

Also consider the role that audiovisual supports might play in your presentation, asking yourself: What does the audience need to see in order to follow the talk? A variety of audiovisual aids -- slides, overheads, flipcharts, videotapes, audiotapes, computer displays, paper handouts -- can be successfully incorporated into a presentation. Practice using different devices to see which ones work best for you. And always -- test your materials on a real audience to see what works best for them.

Remember that audiovisual aids lose their effectiveness if the visuals cannot be seen, and the audio cannot be heard, clearly. A good preliminary test to determine relative legibility of an overhead is to stand with the overhead on the floor by your feet. If you can't read it, then neither can your audience! The old adage that "less is more" applies here as well; one of the most common failings in slide shows is having too much information on a single slide. Your point is more quickly made by using phrases rather than full sentences, and by keeping the points on each slide few in number.

Remember your time allotment! In general, presentations are scheduled in 70 minute blocks -- you should budget your time accordingly. You will need to allow time for audience questions at the end: this can be some of the most valuable time spent in a session. You also want to be able to speak in a somewhat leisurely fashion: although an audience may like a fast-paced production, they don't want to have to concentrate on too-rapid delivery by the speaker.

Practice in public, arranging at least two (one initial, one after feedback) trial presentations at your home institution. Your practice audience should include both persons who are and who are not close to the project. They can prove to be an invaluable resource in terms of identifying problems in understanding, hearing, visibility/legibility, flow, and context. They can also help you determine the need for handouts and -- if used -- can evaluate the effectiveness of those handouts.

Remember the other unspoken rule of speaking: Don't rely on memory alone! Bring an outline or a set of numbered notecards to refer to in case you lose your train of thought and can't recover; similarly, consider posting a large outline where everyone can see it -- your audience may like to know where you are in the talk so they can pace themselves and plan their questions. (Be sure to announce at the onset of your talk how you prefer to handle any questions from the audience: do you want them to hold questions till the end? or raise a hand and ask during the presentation?)

If your talk is heavily sprinkled with acronyms, you may wish to prepare a poster or a flipchart with translations of the acronyms. If you need to refer frequently to a complex diagram, consider distributing handouts of the diagram.

Speaking pitfalls are everywhere -- but practice can make you almost perfect. Try to weed out the colloquial pause-fillers of "um" and "uh" and, although you don't need to be <u>formal</u>, do try to employ good English. As always, attempt to use gender neutral language in your speech. Finally: remember that humor is great if it works for you -- but don't try to "entertain" if that's not your style.

There is a large body of literature on the market which focuses specifically on public speaking and the preparation of audiovisual supports for speeches. Take advantage of these publications, and learn from other people's mistakes so they won't become your own.

Going to the Conference

Any last minute thoughts? This warning may sound unnecessary, but it is based on a wealth of observed experience: if you're relying on slides, overheads, handouts, whatever -- be sure you know which member of your party is responsible for bringing each item. If you're flying to the conference site, carry your materials -- including any speech cue-cards -- onboard with you: lost luggage, like most inconveniences, always occurs at the worst possible time.

Consider other conference attendees as possible resources during your presentation. Is there someone from your campus familiar with the project, or someone from another institution knowledgeable in the field? You may want to solicit their support (at least, their physical presence) at your presentation; during question and answer time, these resource people may be able to add additional information that will enhance your audience's learning experience.

At the conference, what can YOU do to maximize your chances of success? First and foremost: take advantage of all the possible assistance provided by the local committee staff. CUMREC really wants your presentation to go well. To that end, at every conference they provide:

-- a practice room, similar in size and shape to the actual presentation rooms and containing similar equipment, open extended hours during the conference (you can sign up for time in the practice room at the conference registration desk);

-- a reception for speakers and moderators, at which you can meet the moderator assigned to your session (the moderator identifies the session number to be written on the evaluation form, reminds the audience to complete an evaluation, introduces the speaker{s} and generally sees to it that the session begins and ends on time);

-- a room monitor, assigned to your specific presentation (the monitor ensures that equipment is working and will locate assistance in the event of room/equipment problems);

-- a staffed registration desk, your first place to turn if you have a question or a problem.

What else can *you* do to enhance your presentation outcome? If yours is not the first session on the conference schedule, you can pick up some helpful hints by observing other speakers' presentations. Ask yourself what you especially liked in a talk -- and what you liked less. Be at your assigned room early! Make contact with your moderator and room monitor, verify that equipment is positioned correctly, that handouts are located conveniently by the door, and that the room monitor knows which light switches you want adjusted during the talk. Most of all: be excited about your subject . . . *and enjoy yourself!* If you feel relaxed and comfortable, you will put your audience at ease -- and they will enjoy the program more.

Try not to be nervous! Fear of presenting is one of the biggest obstacles to making the initial commitment to present, as well as to following through with it. *"Think of your speech as a big staff meeting. Particularly at CUMREC, the people are really interested in what others' experiences have been -- CUMREC gives you the opportunity to talk to your colleagues about these experiences, and learn from theirs."* (Marla Thomas, University of Kentucky-Louisville)

A word of caution on what to expect from your audience: remember that an audience is not static -- with all good intentions, attendees may enter a program late and leave the program early. Don't take it as a personal affront; just keep going!

It's finally over -- now what? Celebrate! You really did it! You can be proud of yourself, and be assured that CUMREC, too, appreciates all the hard work you've done. Do remember, in the midst of the flush of success, to thank the people who helped you prepare your paper and presentation. Drop a note to your boss, who provided you with the institutional (and financial) support to

attend this conference. Send a thank-you postcard from the conference site or bring back a treat for your fellow workers and staff (who put up with you, perhaps even took on extra work, while you were busy with your CUMREC responsibilities). The winners of the CUMREC '92 best paper award took the time to telephone the creator of a particularly effective videotape, apprising her of the award and thanking her again for her efforts (Jack Duwe and Tom Scott, University of Wisconsin-Madison). These gestures go a long way toward making others feel good -- and may help facilitate any future CUMREC presentation endeavors.

Other things to remember, when you return to your home campus: Share the results of the presentation; give feedback on the conference to relevant offices and staff. And don't forget to update your resume to indicate that you were one of the selected conference presenters this year!

Best Paper Award

The evaluations handed in by your audience at the conference presentation (see Appendix B), combined with the original score assigned your written paper by the Program Committee, make up your overall score. Note that, in the oral presentation, evaluation scores are totalled and divided by the number of evaluations, so that the less heavily attended presentations are not disadvantaged. It is the committee's goal to announce the winner of the best paper award, as well the other top papers of the conference, at the closing plenary session on Wednesday morning. The names of the top papers, their authors, and the authors' institutions are announced in the first CUMREC Newsletter after the conference, in late June or early July.

Conclusion: Why We Do This

We have already pointed out some of the benefits to be accrued by participating in the writing and presentation process. Obvious benefits are derived, certainly, by the authors/presenters themselves. When asked what was the best part of presenting a CUMREC paper, former presenters responded enthusiastically: *"Making contacts with people who are doing the same thing you are, or who are moving in that direction. Most are willing to share how they did it and the exchange of ideas improves both. The ones moving in that direction have followed up with questions and thoughts which triggered 'light bulbs' in my head to make changes that have improved my system."* (Lee Anne Hoppe, Virginia Tech)

Benefits derive to the authors'/presenters' institutions: *"We are constantly asked to send information about our project to interested parties at other institutions in Wisconsin and throughout the country. One of the major benefits of writing the CUMREC paper has been that we now have the right kind of document to send in response to such requests. If we had not written the paper for CUMREC, we would still be responding to these requests with bits and pieces of separate related documents that may or may not fit together very well."* (Larry Rubin, University of Wisconsin-Madison)

Benefits also derive to the conference attendees, who are able to select from a broad array of presentation topics to enhance their own knowledge and experience. And, ultimately, it is the CUMREC organization itself that benefits. The conference owes not only its success, but its very survival, to the presenters and participants who gather together each year to share their experiences and help each other strive for ongoing success in higher education computing.

Appendix A

CALL FOR PAPERS

1992 — Discover New Worlds With Technology

CUMREC '92

INTENT TO PRESENT: I plan to submit a paper to be considered for presentation and publication at CUMREC '92 on the following general topic:

____

____

PLEASE PRINT

Name ______________________________

Title ______________________________

Institution ______________________________

Address ______________________________
Street or PO Box

____
City

____
State (Prov.) Zip Code (Postal Code)

Telephone ( ) ______________________________

Authors Release, Warranty and Understanding

If this paper is selected for presentation at CUMREC '92, I/we grant and assign CUMREC '92 the right to publish the resulting paper prepared for the Proceedings of the Conference

I/we guarantee that I/we are the sole proprietor(s) of the work and I/we have full power to make this agreement, that the work does not infringe on the copyright or other proprietary right of any other person, and that the work contains no libelous or other unlawful matter and makes no improper invasion on the privacy of any other person

I/we understand that those who present papers at CUMREC '92 must register for the Conference and pay the Conference fee. I/we also understand that I/we will not be paid any honorarium or fee for the presentation or its preparation, nor will I/we be reimbursed for travel or any other expenses incurred

Author(s) Signature(s)

______________________ Date ________

______________________ Date ________

INTENT DEADLINE: September 30, 1991

SEND INTENTS TO: CUMREC '92, Debbie Stedman, P.O. Box 16-1824, Miami, FL 33116

Appendix B

PRESENTATION EVALUATION

CUMREC Paper Presentation Feedback

Session Number: _____

To assist the CUMREC Program Committee with the selection of the Best Paper Award, please rate the quality of the paper presentation from 1 to 10, with 10 being the highest score and 1 being the lowest. When rating the paper, consider such criteria as organization, completeness, clarity of communication, integration of graphics (if applicable), and technical accuracy.

(Please circle)										
RATING	1	2	3	4	5	6	7	8	9	10
	(Lowest)									(Highest)

CUMREC BAYLOR UNIVERSITY '93 San Antonio

INFORMATION TECHNOLOGY: The Revolution Continues

INFORMATION RESOURCES MANAGEMENT

M2-4

Planning Successful Education and Training for Information Systems

Byron M. Anderson
Texas Tech University

38th Annual
College and University
Computer Users Conference

Hosted by Baylor University
in San Antonio

May 9–12, 1993

2:9

Planning Successful Education and Training for Information Systems

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Education and Training **(E&T)** for Information System **(IS)** users is an on-going and non-ending process. Every Management Information Systems **(MIS)** provider is faced with an initial E&T effort during system implementation. After implementation, employees come and go, resulting in a user base with constant turnover. Each time an employee leaves the institution, someone feels the impact from the loss of an "expert" user of the IS. Likewise, when a new employee comes aboard, someone is faced with the task of educating and training the new user.

This paper will describe the information which IS users need, and then present a guideline for developing E&T programs. Since several acronyms (such as E&T, IS, and MIS) will be used in this paper, a list of acronyms is provided on the last page.

WHEN ARE EDUCATION AND TRAINING NECESSARY?

How many times has someone hung up the phone in disgust and said, "Those dumb users -- they don't know what they are doing!" Many times uninformed users are major frustrations -- someone is trying to use the system and does not know what he/she is doing.

Maybe someone calls to say the data is not right, or the program is not working correctly. But examination and testing reveal that "the information is right!" and "the program does work correctly!" Further discussion with the user discloses a user who does not understand either the industry (see "PDI" below) which originated the IS application, or the procedures which drive the IS, or how to interpret the data being reviewed!

Interruptions -- think of how much could be accomplished if there were less interruptions! Interruptions take time, which presents an additional, and very obvious consideration: Not only do interruptions indicate a need for

training, but they also indicate a very real cost -- labor is less productive than desired. Both you and the end user will increase productivity if inquiries and interruptions are be reduced or eliminated.

These few examples show the potential success from E&T -- a reduction in problems and distractions (and resulting labor costs!!) may be realized by several different departments, which means there will be multiple benefactors from a successful E&T program.

WHO ARE THE PRIMARY BENEFACTORS OF E&T?

The rewards received from a good E&T effort will be realized by three different and distinct benefactors:

The **MIS Department** is the provider of data processing services such as application programming and computer operations.

The **Proprietary Department of Information (PDI)**, which is the primary user and processor of the data, is the information authority, possibly being responsible for compliance with governmental regulations. PDI can refer to departments such as Human Resources (sometimes referred to as Personnel), Accounting, Budget, Student Records, etc.

For the purposes of this paper, **"end users"** will refer to the users of the IS who are beyond the PDI. These departments have inquiry or data entry uses of the IS, but not as the primary (ie., PDI) user of the IS.

Before proceeding, it must be mentioned that end users view E&T as another service from MIS and/or PDI. If MIS and/or PDI are not user-friendly, and their services do not meet the needs of the users, then the E&T effort will be poorly received and less successful. Furthermore, successful E&T is partially a result of educating the users in the language and relationships of MIS and/or PDI. When relationships between the associated departments are competitive or combative instead of cordial and user-friendly, there are questions which cannot be answered to the end users. A certain amount of confusion and uncertainty will remain and the proficiency of the end users will not fully achieve expected results. For these reasons, E&T will achieve greater success when it is supported by service-oriented MIS and/or PDI.

Now that you have read to this point, it is only fair to say that this paper focuses on the E&T of the end users. If your IS does not have end users other than PDI, you will

find that the MIS and PDI were involved during IS definition and testing, and should be familiar with the system at the time of implementation.

WHAT REWARDS AND BENEFITS CAN E&T OFFER?

Because several IS benefactors exist, the rewards and benefits of E&T can be multiple and simultaneous.

First, when E&T are provided to coincide with implementation, dual short-term benefits occur. End users become functional and proficient in their departments within a shorter time, while IS implementers (both MIS and PDI) return to their normal jobs sooner.

Second, when E&T is provided on an on-going basis, multiple benefits occur. As new users become functional and proficient for their departments within a shorter time, IS support personnel (both MIS and PDI) experience labor and productivity gains from the absence of problems and interruptions.

Even when formal E&T programs are not in place, the startling fact of life is that E&T is occurring on an ad-hoc, informal basis. This ad-hoc, informal E&T is not only inefficient, it increases labor costs as new users learn from two primary sources: from help-calls to the PDI and MIS, or word-of-mouth from someone down the hall. Learning from either help-calls or word-of-mouth suffers from the same maladies: Questions are interruptions occurring at inopportune times which may not receive appropriate time and attention, and are often answered by someone who provides incomplete or incorrect assistance.

Two negative reactions result from this ad-hoc, informal E&T. First, the MIS, PDI, and down-the-hall support departments are experiencing unwanted and unnecessary labor and productivity losses. They typically respond in a manner to "fix" the situation, and rarely take the time to discern and explain information gaps that come from misunderstandings or lack of knowledge about the underlying concepts and terminology of the MIS, the PDI, or the application.

Second, users are becoming proficient in bits and pieces, relegated to positions of learning by failing, of learning without receiving important background information, and of never learning the "why's" of their situation. They never receive the benefits from a "large picture" system overview, from discussions of integrated components, and from the application of the IS to the their "real world."

In summary, the benefits from a successful E&T program will be seen in increased productivity of all concerned -- MIS, PDI, end users, and down-the-hall helpers. However, for E&T to be the most beneficial, it is important to understand the definitions of and differences between "education" and "training."

WHAT ARE "EDUCATION" AND "TRAINING?"

Surprisingly enough, there is a large difference between "education" and "training" as used in this paper. *Education* refers to presenting information that will provide an understanding of the IS and any terminology which is used. The primary effort is directed at describing the concepts and terminology **(C/T)** which form the underlying foundation of the IS system. Learning that users must obtain "user identifications" and use "passwords" to "Logon" and "Logoff" are C/T from the computer industry.

To be most effective, education should recognize that the MIS and the PDI represent two different industries with separate C/T (MIS is an industry, Personnel is an industry, Finance and Accounting are industries, higher education is an industry, etc.) The purpose of education is to present the appropriate information about all the industries involved so that users can understand the IS system and interpret the terms they will see on reports and inquiry screens.

Training refers to developing users' skills so they can do their work. Learning how to log on and off the IS system is a skill. Other skills include using the commands to perform inquiry and data entry procedures, preparing input documents, reading and reconciling reports, etc.

To be most effective, "training" must rely on the foundations of the C/T presented during "education," but the purpose of "training" focuses on how to use the system. It should be closely aligned with the daily activities of the users so that they are prepared to go to work upon completing class.

"Education" and "Training" often occur hand-in-hand where there is little distinction between the two as separate formal activities. The need for both "education" and "training" can be illustrated by two typical situations:

- A trainer may jump directly to "training" activities to show how to use the system, and overlook the importance of C/T education. As a result, the users will continue to struggle in the class room, and will leave talking about how hard or difficult the system is to learn and use.

- A trainer may unconsciously view "education"-style presentations as adequate, saying, "I told them how to do it." However, user help-calls indicate the users still do not know how to "do" the basic operations once they return to their jobs, because they did not receive skills training.

Questions from the users during presentations or class activities will often indicate the need to review C/T. "Dumb" questions may indicate a lack of understanding of basic C/T and the trainer may need to explore the user's question to determine if the missing knowledge is related to the MIS, the PDI, or the IS application.

In summary, education and training are two integrated parts of one process, and both must be included to provide the greatest benefit to the institution. It is important to recognize that

- *"education" is used to prepare someone's understanding before "training" can provide skill development.*
- *"education"-type presentations alone may not provide the skill development for someone to become a good user of the system.*
- *"training"-type presentations alone may not be comprehended by the users and may not bring anticipated results.*

WHERE DO YOU START TO DESIGN AN E&T PROGRAM?

The design of an E&T program begins with an examination of the users of the IS. In the language of the training industry, this is referred to as "Audience Analysis." Two questions should be asked initially:

- "What groups of people can be identified as users?"
- "What do the user groups want or need from the IS?"

These "wants and needs" of the user groups are very important. The users are interested in what the IS will do for them. They want to know if the IS will solve their problems or prevent errors. Therefore, for an E&T program to be successful, it must show the users which features will help them be more productive.

These two questions will, first, define the depth and breadth of the E&T which is required, and second, indicate how to structure and package E&T for delivery to specific user needs. However, the answers to the two questions should be further examined by asking a third question:

- "What C/T do the user groups need to understand in order to interpret the information they want and need from the system?"

This third question is an important key to providing successful E&T because the answers indicate what education to provide the users so they can understand the IS.

The final design consideration is the language of communication. Knowing what to present is only part of the problem -- knowing how to express the information is equally important! E&T must be provided from the perspective of the user, *and not* from the perspectives of MIS or PDI. Users will comprehend E&T with greater success when it is expressed in their language -- when C/T are defined and illustrated in the words of their daily vocabulary. Here are two examples of poorly expressed E&T:

- A highly qualified presenter from MIS provides E&T with too much information about data bases, files and file names, computer and data processing information, and expresses it in language laced with C/T from the computer industry. The result is that the users sit through information they do not understand and will not use, attempting to glean the information they want and need.
- A highly qualified presenter from PDI provides E&T with information on how to use the IS without explaining background C/T and expresses it in the language of the PDI. The results are that the users may not retain important topics because they do not understand the language, and then they try to use the system without knowing why they are following certain procedures.

Before leaving this topic, it is important to note that E&T for the implementation of a "new" IS may be able to build upon the present knowledge of the current users in order to fill the gaps between the old and new system. This is an instance when abbreviated E&T can bring successful results.

In summary, successful E&T is built upon a foundation of

(1) providing the information and skills
(2) the users want and need
(3) in the language of the users.

WHAT ARE SOME TYPICAL USER GROUPS?

While every IS will have variations of the user groups involved, the following is a list of possibilities for a large system accessed by every department, such as the personnel or budgetary IS.

Executive Management. The President, Vice Presidents, Deans, etc., will require very little E&T. A summary pre-

sentation will probably be sufficient (their concerns are usually institution-wide and they receive summary information prepared by their administrators). The greatest opportunity for E&T is during initial IS implementation, when their primary interest is in time line progress and expected benefits.

Management E&T. Department Heads -- Chairpersons, Directors, Managers -- will be interested in an overview of the information that is available to them and in the C/T they need to effectively communicate with their staffs. Depending on their personal management style, they may be interested either in where to find budget balances or current employee information on reports or inquiry screens, but they are rarely interested in detail reports, transaction lists, and source documents, or in the details of the processes and procedures that are followed.

End Users. This group will be further categorized according to their uses of the IS. Are data entry and inquiry centralized? Or is data entry selectively decentralized and with inquiry available to anyone? User groups might fall into some of these categories:

- **Source document preparation** of budgeting, purchasing, and personnel forms which will be data entered in the IS. Users will need detail "education" in the C/T of the MIS, the PDI, and the documents they are preparing.
- **Restricted data entry,** where only certain data entry processes are decentralized. Users will need detail "education" in the C/T of the MIS, the PDI, and the processes they are entering. Then they will need "training" in the relevant entry hardware features, hardware operations, data entry procedures, and balancing and verifying procedures for the processes they are entering.
- **Restricted inquiry,** where only certain inquiry screens are available to the users. Users will need detail "education" in the C/T of the MIS, the PDI, and the screens they will access. Then they will need "training" in the relevant hardware features, hardware operations, inquiry commands and procedures, and how to cross reference their source documents to their inquiry screens.
- **Unrestricted data entry and/or inquiry.** Groups such as these will need expanded versions of E&T as described for the selective groups.

Proprietary Department. E&T for this group will be largely determined by the development and implementation plan followed by MIS (they might receive some MIS or vendor-supplied "education" in the beginning to facilitate their

involvement). When PDI participates in the plan, they will learn "on the job." If PDI is not involved with MIS in the plan, they should be viewed as the end users described above.

On-going E&T for PDI's employee turnover will probably be best provided by PDI, due to the highly technical nature of the information. However, attendance at end-user E&T for data entry or inquiry is highly effective for giving the broad overview and background on which the technical in-department E&T is based.

IS Department. Like the PDI, MIS will pursue E&T in-department, or from the supplying vendor. Once again, however, on-going E&T for employee turnover can be facilitated by attending end-user data entry and inquiry E&T to build a foundation for the more technical MIS E&T.

In summary, identifying the user groups is a step toward determining the E&T which must be provided.

WHAT DO USERS WANT AND NEED?

Research of end user wants and needs revolves around the question, "What do you want to do?", or if asked of the PDI, "What do you want the users to do?" This refers to the results that the end users want or need to accomplish.

End users may reply, "I want to look up my budget balances," or "I want to see if an employee was paid correctly."

PDIs might reply, "I want end users to see if a check was issued to the vendor instead of calling me," or "I want end users to enter their own time cards."

These replies from the end users and PDI can be used to build the following list of training topics:
(1) Budget balances inquiry.
(2) Employee time card entry and payment inquiry.
(3) Vendor payment inquiry.

Notice item (2). Questioning both benefactors has turned up related topics which may be packaged together for E&T purposes.

The questions and answers presented above are expressed in "training" language -- how to "do" things. Next, it is important that the research goes a step further to determine what C/T "education" the users should have in order to

achieve the desired results. Following might be "education" examples for the topics listed above:

(1) Budget balances may include several types of totals and involve one or more procedures. For instance, budget balances may include revisions to the budget, encumbrances, expenditures, etc. which need to be defined as part of showing a user which inquiry screens list budget balances. Additionally, the procedure of encumbering and expending funds may need to be explained so that the user can interpret the information on the screen.
(2) Before time card entry and employee payment can be presented, it may be necessary to discuss time periods, cut offs, and processing and payment dates.
(3) Looking at a screen indicating vendor payment will be more meaningful if the user understands invoice and payment processing procedures.

In summary, E&T for inquiry and data entry must necessarily go beyond how to access or enter the information to include the C/T inherent in the IS.

HOW ARE E&T COURSES DEVELOPED?

From the above list of topics, we can begin the process of developing our E&T programs. We will follow a simple procedure of sequencing the material, defining learning objectives, and designing participant activities.

(If you are having trouble understanding this last sentence, it may be because I have not previously discussed training industry C/T such as "sequencing the material," "learning objectives," or "designing participant activities" -- and now you know how difficult it may be for an end user to understand someone from MIS or PDI!)

Sequencing the Material

The first step is to determine the sequence for presenting the topics. Asking two questions will assist in "sequencing" the material:

- "What does the user need to know first?" This question will assist you in determining the order of your topics. In the second topic listed previously, you may determine that a user should learn how to inquire for payroll information as a prerequisite to the topic of entering data, ie., it may be easier to teach data entry if the user knows what the targeted end result should be!

- "What does the user need to know in order to learn this topic?" Now you are asking what background education is necessary so that the user will comprehend the topics to be presented. Again looking at the second topic above, you may determine that the user must understand and be able to do certain math computations as a prerequisite to learning about payroll entry and inquiry.

Using the answers to these questions, here is a "sequenced" topic list for time card entry and payment inquiry:

a. The C/T regarding payroll time periods and cut-off, processing, and payment dates.
b. Formulas and computations used in computing pay.
c. Inquiry commands and screens for viewing employee payments.
d. Data entry processes for entering time cards.

These are very broad topics which might be further divided into sub-topics. For example, the last topic about data entry will include sub-topics about error messages and error recovery during entry.

Defining Learning Objectives

Now that we have our "sequenced" topic list, we will re-state each topic (and sub-topic) as a learning objective, which accomplishes two important steps in our training development:

- Objectives focus the effort of the trainers toward accomplishing certain goals. Remember, the overall goal of training is to reduce errors and increase productivity. The objectives will become the steps we will follow in pursuit of that overall goal.
- Objectives must be stated from the perspective of the users, which helps the trainer think in the language of the users. It is the users who must be able to "do" certain things, and only if the users "do" those things when they return to the job can we say our training has been successful. Expressing from the perspective of the users also serves to change our focus from "telling what we know" to "giving the users what they want and need."

Here is a simple "User-action-task" guideline for writing your learning objectives:

- **User.** Start your objective with "You will be able to ...". This causes you to focus on the perspective of the end users and what they must "do."

- **Action.** Follow the intro with an active and measurable verb that represents what the users will be able to "do" after receiving training. This means you must imagine what the users can "do" that will indicate what they have learned.

  The most common pitfall is to use verbs that may seem active, but are not measurable. This occurs most frequently when you are defining objectives for C/T. The sub-topic of error routines for data entry is a good example. You want to teach the error codes and their respective meanings. The tendency is to write your objective as "You will be able to (understand, learn, remember, etc.) ..." However, these verbs are not measurable. How can you measure "understanding?" Instead, you should use verbs such as "You will be able to (describe, recite, list and define, etc) ..." Active, measurable verbs set the criteria for observing and determining if the users have learned the desired topic.

- **Task.** Complete your objective with the task to be learned, which the users should to be able to do when they return to their jobs.

The following might be the list of learning objectives for the topics we have discussed previously:

You will be able to:

List and define the cycles of recording time and paying employees.

Describe the various formulas and computations used to compute pay.

Select and view employee payroll information stored in the computer.

Enter and reconcile time card information for employee payrolls.

Looking as these examples, you will note that the objectives have been worded in language that the user will understand. The importance of this is described in the following section.

WHY SHOULD LEARNING OBJECTIVES BE WRITTEN IN USER LANGUAGE?

From the standpoint of the trainers, we have already discussed the importance of thinking and expressing from the users' perspective. In addition, the E&T program benefits from properly stated objectives in three related efforts.

1 E&T Brochures. Most users ask, "What will I get out of this training?" The learning objectives answer that question. They are "publicity" or "marketing" verbiage that express the benefits of attending E&T. These learning objectives can be used to create training brochures, confirmation letters, posters, etc.

2 Class Evaluations. As class is completed, you will want to have an evaluation to get the users' feedback. The learning objectives can be used as two sources of feedback:

* To find out how the users rate themselves. Simply restate the "user" beginning of the objective to, "I am able to ... ," and ask the users to rate themselves on a scale.
* To find out weak points in the training program. After the users have rated themselves, the trainer can review the evaluations to see which learning objectives were rated lower by the users and therefore need more time or emphasis during class.

3 Certification. If you want to have employees "certified" as to their competence in the IS, your learning objectives will form the basis of your testing program.

In summary, learning objectives, when they are properly stated, can be used as a consistent thread through the training program, from the first publicity a user sees, through the training program, to the evaluation or certification testing at the end.

<u>IS THERE A WAY TO MAKE LEARNING EASY FOR THE USERS?</u>

The easiest method for the trainer is not necessarily the best method for the learner. For example, a lecture might be easy to prepare and adequately cover the training topics but might not provide adequate learning opportunities for the users. E&T will provide better learning opportunities when consideration is given to <u>how adults learn</u>.

The adult education industry has accumulated research about how adults learn best, and the simplest statement is to say that adults prefer to be participants instead of recipients of E&T. This means that adults prefer education that allows them to experience and test their experiences -- "activity based" E&T. You should keep the following in mind when developing E&T for adults:

- Adults are result oriented, and expect information to show them how to "fix" things or remove barriers. They expect what they learn to be immediately useful, will apply new information to present circumstances, and

will place greater value on the things that will produce results on the job.
- Adults want to participate in the process. They rely heavily on their past experiences and beliefs. They will measure new information against what they already know and want to test new information for validity.
- Adults function best where they can draw on their experience, act as a resource to the trainer and others, collaborate as a group, and share in planning or decision-making.
- Adults will remember more information for a longer period of time if they have an opportunity to use the information successfully in class before returning to the job.

To provide E&T that is most effective for adults, you should plan activities for your learning objectives. The activities should allow the users to process the new information or cause the users to make decisions based on what they have learned. Looking at our list of learning objectives, you might design activities as follows:
- A discussion about the C/T related to pay periods can be followed by a matching terms exercise, a story that requires the users to establish pay periods, or true/false exercise that tests the users' comprehension about various aspects of the information.
- A discussion of computations and formulas can be followed by math exercises that test users' understanding of the material.
- A review of on-line screens can be followed by guided exercises where users review their own departmental employees for certain information.
- Data entry reviews can be followed by exercises where users enter sample data.

In summary, activities are the best form of E&T for adults. Activities are most effective when presented as exercises instead of tests, when users are allowed to work together, and when answers are reviewed in open discussion. Activities can provide settings where adults have the opportunity to relate the material to their present on-the-job work.

HOW DO I CHOOSE SOMEONE TO PREPARE THE E&T PROGRAM?

Choosing the person who will lead your E&T effort is a very critical factor in the overall success of your E&T program, as shown by the following:
- As we have seen, this person should be able to understand and communicate the important C/T's of the MIS, the PDI, and the application.

- You may be able to select an individual from either the PDI or the MIS, but the chosen specialist should be able to communicate <u>in the language of the users</u>.
- If you want the users to perform IS functions ("do" the work), beyond just "knowing" critical information about the IS, then you want to view E&T as a learning experience for the users. This calls for activities which allow skill development for the users, and allow the trainer to observe, measure, and evaluate the users' new abilities.

One danger in selecting an E&T specialist is to assume that the obvious choice is a "technical expert" from PDI or MIS. Here are some possible pitfalls:

- Trainers are often appointed from the MIS or PDI as the most knowledgeable spokesperson (technical expert) without a background and understanding of education and/or adult learning theories;
- "Technical expert" trainers may unconsciously use C/T which is everyday language in their home department (MIS or PDI) but is unfamiliar to the users. Two results may accompany this occurrence:
    * Users may not understand the presentation, and after the class will talk about how hard or difficult the system is to learn,
    * Users will often evaluate their trainers in glowing reports as an expert with an excellent background, and refer to the class as a great experience, and at the same time return to their departments and struggle with the most basic operations.
- It must be noted that evaluations prepared by users who do not understand the material can be misleading. Users who do not understand the trainer or the material will often give excessively high ratings to the class and trainer when compared to users who have a level of proficiency and understand the trainer and the material. This is another reason for objectives to be active and measurable, and E&T to be activity based -- the trainer must be able to observe the participants to see that the material is comprehended.

For these reasons, it is advisable to consider that "technical expert" trainers, while recognized for their proficiency, may not communicate in the language of the users, and they may receive misleading class evaluations while not achieving expected results.

In summary, you want to choose someone who is a good communicator, who understands the C/T's involved, and who offers E&T to meet the needs of the users.

S U M M A R Y

Providing education and training for information systems is more than dispensing information and reviewing system features. The information must include the concepts and terminologies from both computer and information industries so that the users can understand the information system. The reviews of system features must allow the users to practice and demonstrate their competency prior to leaving the class.

For education and training to be successful, the achievements of the program and the participants should be measurable by the trainer. By designing and developing adult-targeted activities with learning objectives, education and training become measurable, and comprehension is observable by the trainer!

The success of education and training will be evidenced by users who become self-sufficient, and by information system providers who are less distracted by interruptions and problems.

In the final analysis, many departments will benefit from education and training programs that assist the employees (and the institution) increase personal and corporate productivity.

LIST OF ACRONYMS

E&T	Education and Training
C/T	Concepts and Terminology
IS	Information System(s)
MIS	Management Information System Department
PDI	Department of Proprietary Information

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San Antonio

INFORMATION TECHNOLOGY: The Revolution Continues

INFORMATION RESOURCES MANAGEMENT

M3-4

Revolution in the IS Shop: Re-engineering the IS Workplace

Robert B. Eaton
Rodney C. Schuler
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38th Annuc
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Revolution in the IS Shop:
Re-engineering the IS Workplace

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Islands of Automation and How They've Been Formed.

Since the 1960's, when computers began to be used for administrative tasks, systems development has been focused on individual functions usually performed by one organizational unit. In the finance area, processes dealing with the Financial Accounting were "automated" followed soon by Accounts Payable and Receivable. In the Human Resources area, attention was paid to the payroll function while the foci of automation efforts in Student Records were admissions and registration.

We refer to these systems, sets of computer programs designed and implemented to process the data specific to a functional activity (e.g. Admissions), as *islands of automation*. To extend the metaphor, we may even think of the all the systems used in an organizational unit as a "system archipelago".

In the 1970's systems designers, realizing that the output of one system was frequently used in another, attempted to make them work more closely by "automating" the interactions. One system created transactions that were "fed" into another, more or less automatically. Thus, with the construction of bridges (or causeways, in some cases), began the age of the "Integrated Application System".

An example of this is an "integrated" Financial Records System. At the risk of over-simplifying, the Purchasing subsystem sends invoice transactions to the Accounts Payable subsystem which in turn sends transactions to liquidate encumbrances in Financial Accounting. Rather than integrated, it is more appropriate to refer to these as interfaced application systems since there is merely an automation of the *interaction* between existing systems. They have merely been re-packaged, not re-engineered.

When the Age of Data Administration arrived in the 1980's, it became apparent that these so-called "integrated systems" were misnamed. Data Administration implies managing information as an enterprise [read: institutional] resource. not as a functional resource. This can be illustrated with the attributes Name and Address. The Library maintains the Name and Address of individuals librarians know as *Patron* while the

Registrar maintains Names and Addresses of individuals they call *Instructor* or *Student*. The Controller maintains the Names and Addresses of *Account Administrator*, *Traveller* and *Vendor*. The Personnel/Payroll Office does the same for *Employee* and the Development Office for *Alumnus*. However, a person whose job it is to administer data understands that *Patron, Instructor, Student, Employee, Traveller, Vendor*, and *Alumnus* are the same thing: a *Person* and whether a *Person* borrows books, instructs, studies, works, travels, administers accounts or attended the institution are merely characteristics of that *Person*. This implies that data about the same things are used by many organizational units and applications that support those units' activities.

Unfortunately, systems thinking was not able to deal with this "cross-functionality" since it perceived data only in the context of the function being performed. To the Library System, *Patron* name and address is different from that of the *Instructor* or *Student*. In other words, the Library manages the names and addresses for the same entities as the Personnel Office, the Registrar's Office, the Controller's Office and the Development Office (not to mention others).

Thus, it became apparent that systems thinking had not produced a data resource that was usable by all of the institution's functions that needed to use it. Systems thinking had produced a data resource that was dis-integrated. The same data was being recorded and maintained by many islands in each of the institution's many systems archipelagos.

The Goals of the New Administrative Applications.

The realization of this came as quite a shock to us in Administrative Applications —the computer systems people, since it was clear that we were mostly responsible for it: for twenty or so years we had been the greatest proponents of "systems". We had led the University in an orgy of systems development and implementation during the early and mid-eighties, replacing the library, development, financial, human resources, student records and a host of smaller systems. Most of these new systems were packages and we had been required to tailor them to some degree.

In addition, the twelve programmers, programmer/analysts and systems analysts had become system experts, e.g. specialists in finance, human resources or student records. They received much of their fulfilment by doing good things for their "users" and in response, their "users" expected to deal with certain people whose purpose was to maintain and enhance their systems *exclusively*. At times it seemed that functional managers saw our employees as *their* programmers, that is, extensions of their department. Furthermore, departments that had programmers "allocated" to them for some time, expected that their software would be modified more or less automatically while other organizational units went without attention.

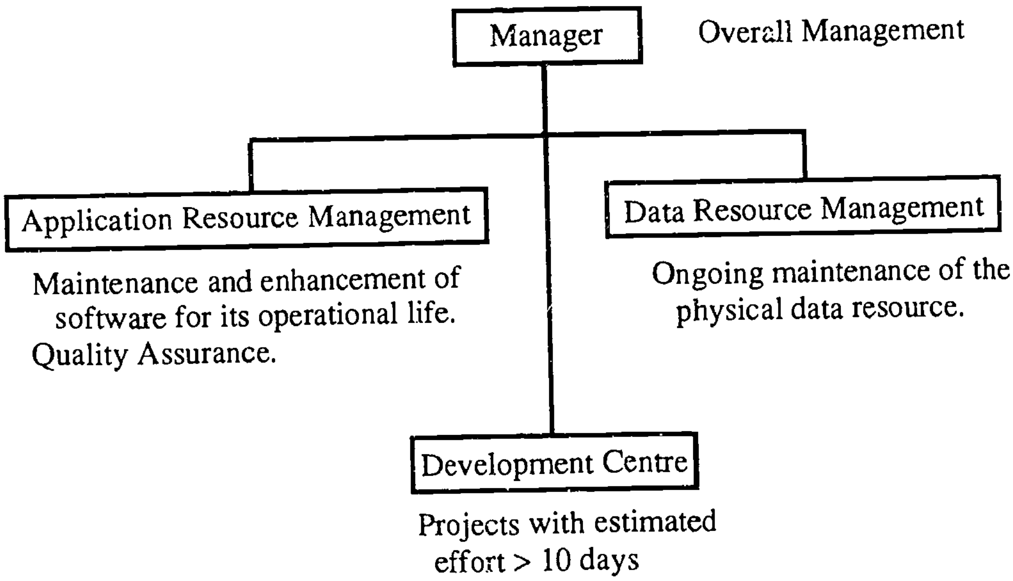
It was clear that we were part of the problem. It was also clear that the status quo had to change and that our group should be prepared to lead this change. Our goal, then, was to give the University a tool to use in its re-engineering efforts: a group of informa-

tion scientists and engineers that could be deployed to create information services for the institution as opposed to operational systems or one functional activity.

To do this we needed to completely change our approach to our business. This new cadre of information scientists and engineers, which we now call informaticians, had to be liberated from the functional silos which they occupied. The obvious answer was to change the infrastructure (the only option management had), that is, reorganize. We also had to re-orient or change our relationship with our external environment. And, of course, we had to re-equip both in terms of hardware and skills.

The New Organization.

Nobody in our group had experienced all three of these changes happening at once. Some of us had moved from organization to organization. During our careers all but our most junior colleagues had changed from supporting one function to another and, of course, we all had adapted to new hardware and software technology. But changing all three at the same time was the same as turning the organization upside down and shaking it.



The Organization of Administrative Applications
Figure 1

Not really knowing what was about to happen, we began. In an effort to engage everyone in the group, the notion that we might not be organized the best way was brought up at the our weekly "chat". Successive chats didn't generate any new ideas; in fact, it appeared that nothing could be changed: everyone was focusing on the reasons why things had to stay the same. To break that impasse, at the next meeting a new organization structure was proposed, one that would address the need for shareable data,

care of existing systems and would free some people for getting us out of the mess we were in. Everyone was asked to think about it, talk about it and criticize it. It was a month before the subject was brought up again but after three months of discussion it was clear what the structure (Figure 1) should be. Most thought that it would not work. Worse yet, many thought that the energy to drive the transition did not exist. Regardless, four months after suggesting that we consider changing our organization, we began operating with the new structure.

The Application Resource Management (ARM) group is responsible for the long-term viability (maintenance) of applications. This includes our current application system legacy, until they are replaced, as well as new data acquisition applications that are developed. The co-ordinator of the ARM is, essentially, a product manager. While the manager of a development project's goal is to produce the product on time and within budget, the product manager has to live with the result. Therefore, the ARM co-ordinator is also responsible for software quality assurance.

The complement of the ARM was chosen somewhat heuristically. An analysis of work completed in the previous three years showed that only two people were needed to keep the legacy systems running. However, that also meant no adaptive changes would be made to those systems. Since we knew that to make the change to an Information Resource Management approach would take a long time, we also knew that *some* adaptive changes would have to be made. Therefore, we decided to have four people plus a co-ordinator.

Led by our DataBase Administrator (DBA), the Data Resource Management group is responsible for managing the physical database environment and the data management tools (our dbms and repository), maintaining the repository, and creating the physical data design on development projects. This group now has a compliment of two full time people.

That meant that the remaining people could be assigned to projects in the Development Centre. There are a couple of characteristics of the Development Centre that should be highlighted. First is it's project orientation. The Development Centre only does projects and, hence, it has no staff - at least not at this time. When a project is mounted, a project manager is appointed who plans the work and is responsible for estimating each task. Once the project plan is approved by the sponsors, the best available people are assigned. These may be informaticians from the Data Resource Management or Application Resource Management groups or they may be from functional areas. When the project is complete, the team disbands and their product is managed by the ARM.

This second characteristic, that the projects are usually multi-disciplinary, is important because it provides a mechanism for cross-functional co-operation or collaboration. Both functional groups and information services are able to work towards a goal that is in the institution's interest rather than that of one group. Resources, usually human, but sometimes financial, can be transferred to the project without one group feeling that it has lost to another.

The New Orientation.

In general, we wanted to leave business re-design to the functional people. This doesn't mean that we couldn't help, but in order to be as effective as possible we decided that our greatest value would be in assisting them to analyze their business practices and, particularly, in understanding which of their business processes were already being performed elsewhere in the institution.

For example, recording a vendor's name and address couldn't be much different from recording a student's name and address —or a patron's, or an employee's. Consequently, if a database and function already exists for recording names and addresses then they can and should be used. Further, the institution's information services professionals are in the best position to know this.

As mentioned earlier, this meant changing people's area of expertise and social attachments. For example, a Human Resources analyst, who was known and valued by the Personnel and Payroll departments, had to become a software scientist and engineer. That meant different expertise in information services and loyalties first to the University and secondly to a functional area. People feel good about being the local expert in a particular area so we had to find new areas in which they would be recognized as authorities.

Identifying new areas of expertise was not too difficult but before assignments could be made employee talents had to be carefully assessed and new skill development encouraged. It began with the understanding that, as Watts Humphrey wrote, we "...probably [had] about the best team we could get... While it is always desirable to recruit better people, it is also wise to focus on making better use of the people we already have. This always pays off."[1]

The first change was to create a Database Administrator (DBA). This was done by naming someone DBA unofficially and then changing a position's description when it became vacant. This position was vacated by a senior analyst who was more comfortable furthering his career in a functional unit. When an organization goes through a metamorphosis such as we did, there are some that choose not to enter the next phase. This suited everyone well: first, he was able to provide needed business analysis in that area and, second, it provided us with a vacant senior position from which the DBA position was created.

Next, we attended to areas of expertise. If we were to work in a project environment, we needed project management expertise. To our great fortune we were able to hire a project management consultant half-time. Her contract specified that, rather than manage one or more projects, she was to tutor those that had responsibility for managing projects. Her job was to instruct those struggling to manage our projects, and she had a phenomenal effect. After she left, one of her protegés was named as our internal project management consultant.

The second area of expertise is business analysis. We understand the role of the business analyst is to construct a a baseline or model from which change can be controlled. The change in this case is the re-engineering of a business areas. Although

larger organizational units could afford their own business analysts, there are many that can not. To address this, senior people who had been marooned on functional islands, but who are analytically sophisticated, are now business analysis experts.

Another area of expertise is emerging technologies of which one of the most quickly emerging is Object Orientation. We recognise that everyone wants to be current but we simply don't have the time for each person to be current with the latest methods and tools. Our object-oriented expert does, though. His job is to be current in what is obviously an important, albeit emerging, area and keep everyone informed.

Finally, we have also created a toolsmith, someone who will be able to adapt the software tools we use so that they can be used as productively as possible. As Watts Humphrey wrote in his book, Managing the Software Process, "...even the best professionals need a structured and disciplined environment in which to do co-operative work. Software organizations that do not establish these disciplines condemn their people to repetitively solving technically trivial problems."[2] On any project, much time is spent on set up, e.g. creating shared directories and libraries, setting protection codes, tailoring software tools and ensuring that all project members know how to use them. These are the types of jobs we have assigned to the toolsmith.

Retooling.

One of the most profound realizations we have come to is that we work together. That may seem obvious but as we began to retool it became apparent that many of the highly touted personal productivity tools were just that -- personal. While making individuals more productive they did little to promote group effectiveness. The most obvious example is personal time management -- computerized or manual. While each person may be well organized, groups of people are forced to co-ordinate their time in the same inefficient ways they always have.

Our retooling goal, then, was to create as collaborative an environment as possible. Of course we wanted people to have as powerful tools as possible but these tools had to promote shared work. Constraints such as complexity or urgency forced us to collaborate to solve a problem or create a software product. Consequently, we wanted to create a hardware and software environment that would, as Micheal Shrage puts it, "...allow two or more individuals with complementary skills [to interact] to create a shared understanding that none had previously possessed or could have come to on their own."[3]

For hardware we chose multiprocessing workstations — VAXstations. Since the software we maintained and developed ran on a VAXcluster, it made sense for us to have VAXes on our desktops. With a 19 inch monitor many executing windows can be open. It is not unusual for an informatician to be working on four or five things at the same time. We have found that there is gain of two hours of productivity for each person per day. That means that four workstation-equipped informaticians do the work of five!

The greatest reason for using VAXstations, however, was software. As part of it's program, "The Education Initiative", Digital Equipment granted campus-wide software

licenses for all Digital software. Consequently, we have an extremely rich software tool environment.

One of the most intriguing tools is for personal time management and project planning. People, projects and facilities (rooms or any other physical resource that needs to be scheduled) have planners. The personal time manager appears as a calendar running on an individual's workstation and can then be used to perform the usual time management operations of booking meetings, defining tasks, and charging time. In addition, other peoples' and facilities' planners can be scanned for availability. When a project manager assigns someone to a task, the assignment shows up in the informatician's planner and the assignment can be negotiated. The same is true or charging effort expended on project tasks.

Software of this sort promotes communication and co-ordination rather than command and control. Note that rather than having people "reporting time" they are encouraged to manage their own time. Time reporting, necessary for project control, is then added value to the empowerment of the worker.

The Toolsmith.

Changing the focus of the Administrative Applications group from individual systems to the institution as a whole requires that there be staff with expertise in specific areas. As suggested earlier, this expertise is not in traditional systems; it is in cross-functional disciplines such as project management, estimation, methods and what we refer to as "toolsmithing": the adaptation of software and hardware tools and environments to increase the effectiveness of other information professionals. It is not possible for employees to be adept with all tools used to define, build and maintain software. These people work in sophisticated environments, using sophisticated tools. They often require assistance since even bright, knowledgeable people do not use tools as effectively as possible or spend too much time "setting up" a project. The "toolsmith" is responsible for maintaining, customizing and investigating software tools, and establishing standard environments to enable the Software Process.

As defined by Watts Humphrey, "The Software Process is that set of tools, methods and practices we use to produce a software product. The objectives of the Software Process are to produce products according to plan while simultaneously improving the organization's capability to produce better products."[4]

The goal of the toolsmith is to relieve other software workers from drudgery by co-ordinating planning, development and support methods, techniques and tools. On development projects, the toolsmith quickly creates a standard development environment that boosts the project team's productivity while supporting change control, and project planning and control. The Data and Application Management groups rely on the toolsmith to ensure that the software tools they use are up-to-date, integrated and as simple to use as possible.

Our software engineering toolkit consists of the following tools:

- An extensible editor that "knows about" languages (Language Sensitive Editor). In addition to giving language syntax assistance, one is able to compile programs and review compiler errors,
- A librarian (the Code Management System) for tracking and controlling changes to source code (programs, documentation, 4GL applications etc.),
- An application building function, (Module Management System) for simplifying and automating the building (compiling and linking) of applications,
- A conferencing tool (VAXnotes) for tracking change requests and communicating with clients and other staff,
- A direct communication tool (VAXMail),
- A document publishing application (DECwrite),
- A windowing environment (Motif),
- A project management application (DECplan),
- A distributed repository of institutional information definitions and descriptions (CDD/Repository),
- An analysis and design tool (DECdesign),
- An application for organizing and automating regression tests (VAX Test Manager).

"Toolsmithing" focuses on four categories, the first of which is extending the Administrative Applications environment. This means customizing the tools that are used to accomplish software definition and support tasks. The client's software environment is tailored during development but attention never seems to be paid to tailoring the development and maintenance environments. Software tools are acquired and simply used (often without reading the documentation). This does not maximize the benefits possible with many of the available tools.

By tailoring our tools we help increase productivity and maintain the standard practices that have been developed. The tools are thus used consistently for all tasks. This is important in an environment where each staff member is expected to support multiple information services.

Much of our time as IS staff is spent editing such things as source code, mail messages, memos, etc. Therefore, it makes sense that the most valuable tailoring would be made to the editor since we use it for so many different tasks. Several extensions have been added to our editor to ensure that it performs all the tasks we need it to do. This allows us to have standard features whether we are editing source code or composing a document.

The second category is infrastructure support for projects. An important aspect of a successful project is that the environment be conducive to collaboration and that it conform to the standards of the group. The toolsmith's job is to create an optimized en-

vironment, so that analysts and developers can almost immediately begin their work. As well, the toolsmith may be able to spot and ameliorate difficulties with tool use.

The third category is consulting support for staff. With short staffing it is nearly impossible for every staff member to keep up with all the new tools and utilities as they become available. Staff members with expertise in various different tools are known to be available as consultants to the remainder of the group.

Monotonous tasks are often time-consuming, and are performed ineffectively by staff because they do not know a better way and do not have the time to investigate and learn one. By having a resource with expertise in the various tools, there is someone who can point them in the right direction and provide special purpose instruction, increasing the capability of highly paid, valuable staff. For example, when the database administrator needed special editing to format database definition statements, a twenty minute consultation allowed the task to be completed within a half hour instead of the estimated one day.

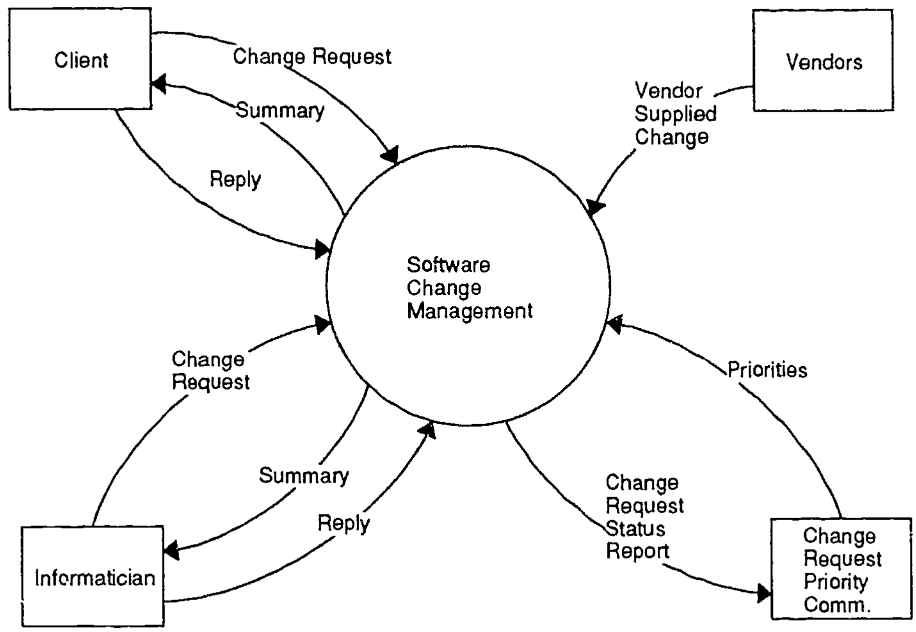
The final category is investigating the applicability of new tools. We have a large number of software tools at our disposal. We know that many of these tools would be useful in our work if we had the time to investigate them. By having a staff member whose job is to investigate these new tools and their applicability to the current environment, the incorporation of new tools and ideas is made easier.

Where a Toolsmith Can Add Value

A model of our change management process was presented at CUMREC 91. This model is now used to illustrate the points where the toolsmith adds value by integrating various tools and providing a standard structure across applications.

Figure 2 (on the following page) shows the context in which we manage software changes. As can be seen there are three sources of *Change Requests*. *Clients* are the functional users of the information systems. *Informatician* is a term defined earlier. We also have maintenance contracts with *Software Vendors* who, from time-to-time, send us bug-fixes or enhancements. These vendor supplied changes (*VSCs*) are also treated as change requests.

Figure 2 also shows that both *Clients* and *Informaticians* discuss *Change Requests* by supplying *Replies* to them. These *Replies* are kept in context with the *Change Request* and are concluded with a final reply, labelled as *Summary*. That briefly sums up the work and anything learned during the completion of the *Change Request*. Periodically, an overall summary of change request work, labelled as *Completed Tasks*, is prepared and distributed to *University Management*.



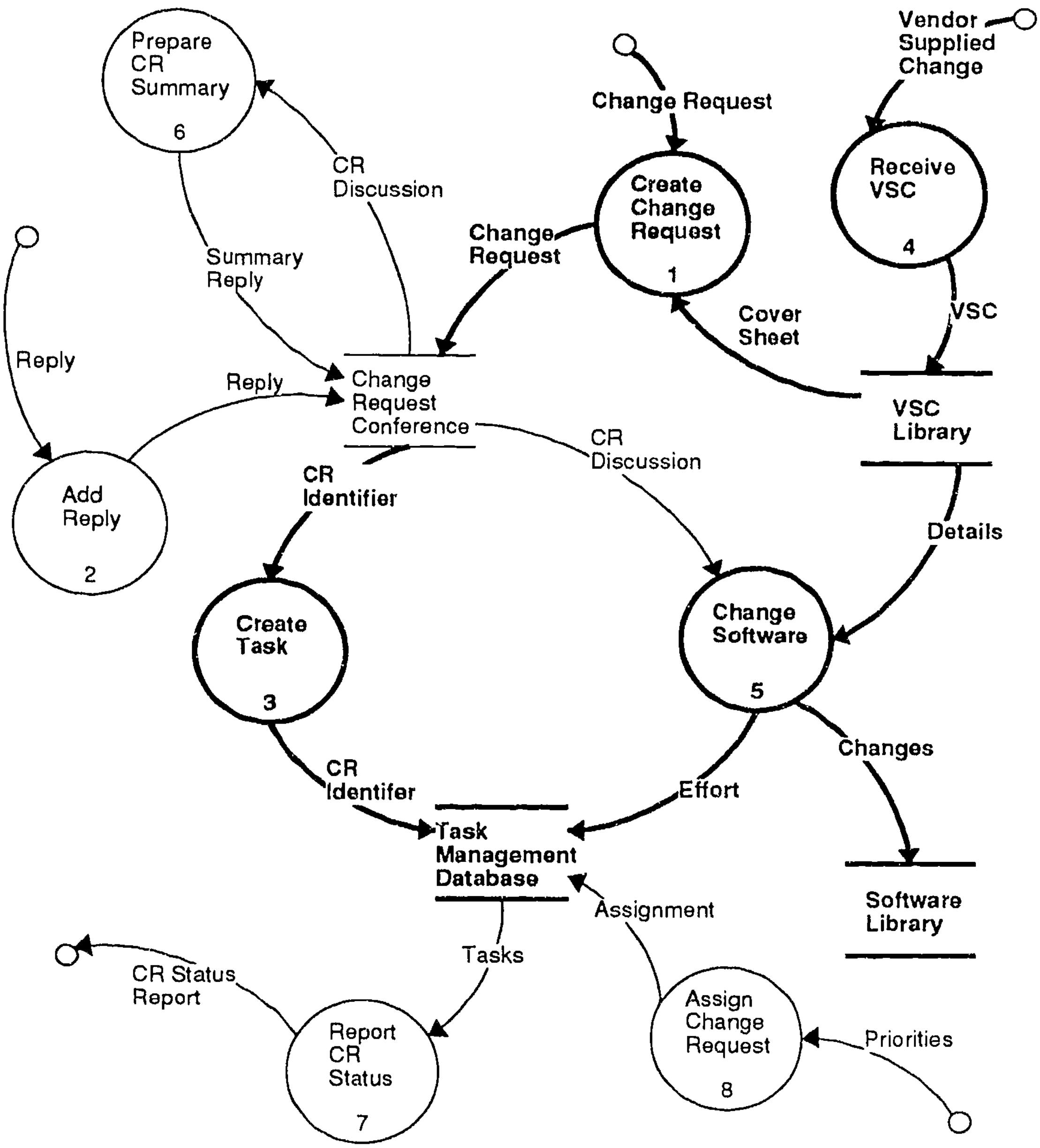
Software Change Management

Context Diagram

Figure 2

The highlighted portions of the process model (Figure 3) show where customizations and extensions have added value.

Receipt of changes from vendors has been automated so that they arrive via Internet mail. The Vendor Supplied Changes (*VSC*) consist of two parts. The first part of the change (or mail message) is the *Cover Sheet* which contains the description of the change, i.e. which bug it fixes. The second part is the actual *Details* (the source code) of the changes. The *Cover Sheet* becomes the *Change Request* and is stored in an electronic conference. The details are stored in a library since it is actual source code. The process of extracting the *Cover Sheet* and putting the details into the library has been automated so that the person on support can accomplish the task with a minimum of effort. The support person edits the VSC in mail, and, via a keystroke in the editor places the *Cover Sheet* into the appropriate *Change Request Conference,* and the details into the appropriate library (CMS).



Software Change Management

Process Model

Figure 3

Since applying the VSCs is simply a matter of cutting and pasting (along with some testing), automated procedures have been created to facilitate setting up the various libraries and loading the source into the editor's buffers to make cutting and pasting the changes easier.

The creation of change requests has been customized by creating a change request language. This creates a template for the change request so that all of the appropriate information such as date required, requested by, etc. is present. As well, utilities such as a spelling and grammar checker have been added to the editor to make creating text for distribution easier.

The actual changing of source code has been customized by adding several templates to the Language Sensitive Editor to support the languages that we use (e.g. pre-compiled SQL, Digital Command Language, etc.). This decreases the number of syntax errors and supports standardization of coding style. Various utilities have also been added to the editor such as rectangular cut/paste, shifting text (helpful for placing text in an if-then statement), and a query for the cursor's current line and column position. These extensions are available to all programmers; not just used by the clever person who developed them, usually in his spare time.

At the U. of S. we store programmer documentation in Help libraries which are used in the office or from home. Individual topics are stored as text files in our CMS library, but rebuilding the Help libraries is time-consuming and boring. Consequently, this final step was often put off, leaving the help libraries not up-to-date. To ensure that the documentation is rebuilt, a local "event handler" has been written. Whenever a specified event occurs (in this case the replacement of a documentation element) CMS invokes a user-defined routine. By having CMS invoke another utility that reassembles the online help library, the toolsmith has automated and standardized this process.

In the change management process there are change requests generated by Vendors, Clients, and informaticians that are stored in a VAXnotes conference. The state of each change request must be managed, i.e. it should become a task in our Task Management Database (Project Management system). With the large number of change requests, manually creating these tasks is cumbersome and error-prone. This was another place where a little assistance would boost productivity and quality (we didn't want to lose any change requests). A procedure was created which looks at all conferences and extracts the new Change Requests. It then filters these change requests to determine which are tasks that must be defined, prioritized and scheduled and which are support issues. The procedure then creates the tasks in the Task Management database (with the appropriate CR identifier).

Predictions for the Future.

The rapid change in price and performance of computing hardware, coupled with equally dramatic forces for change at the University of Saskatchewan have driven the Administrative Applications group to profoundly alter its business practices. Those forces will not diminish and may even escalate. Consequently, while ten years ago we were just trying to get students registered or financial reports produced within two weeks of the month's end, we now are trying to enable students to register from anywhere in the world by telephone and department staff to enter Purchase Requisitions from their desktop computers.

In order to manage that change, however, we will have to develop architectures: explicit ways to depict what should should happen in order to co-ordinate the creative efforts of a number of people. People that develop architecture are known as architects, so in order to address these needs the future information organization must include data, process (business), and technical architects, in addition to the infrastructure support people mentioned earlier.

Finally, new methods of funding will have to be developed to support this planning cadre. We think, though, that as business processes are re-designed and begin sharing already existing information resources, the savings will be so great that the question will become, "Can we afford *not* to invest in new services that share data?" However, the actual methods of accumulating that investment for the building of shared information have yet to be worked out.

Footnotes

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2. Ibid. Preface, ix.

3. Shrage, Micheal. *Shared Minds, the New Technology of Collaboration.* New York: Random House, 1990. p. 40.

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INFORMATION TECHNOLOGY: The Revolution Continues

INFORMATION RESOURCES MANAGEMENT

M4-4

Campus Wide Information Systems: User Publication of Documents

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During the last six years, the University of Texas at Houston Health Science Center (UTH-HSC) has developed a TCP/IP based, open systems network that currently interconnects over 2,300 computers. This network (UTH.TMC.EDU) continues to expand at a rate of about 200 nodes per month and is part of the larger Texas Medical Center Network (TMC.EDU) that includes over 4,000 Internet nodes. The goal is to create an integrated information system that maximizes the sharing of all computer based information. This system must provided information from local as well as international sources directly to individuals as needed, and evolve as technology and standards change. It must also allow information to be easily added to the system by its users.

The TCP/IP based UTH-HSC network began in response to federal initiatives designed to standardize on a single transport protocol for research funded by the National Science Foundation (NSF) and by the National Institutes of Health (NIH). Concurrently, most Unix workstations that were commercially available were being shipped with Ethernet ports and TCP/IP software. A general recognition began to emerge indicating that it might be possible to use the basic TCP/IP protocols to provide a set of common information services among virtually any type of computer. These services included: the simple mail transfer protocol (SMTP) for electronic mail; telnet for vt100 and tn3270 terminal access to remote hosts; the file transfer protocol (FTP) for the exchange of ASCII and binary files; and the network file system (NFS) for client/server based file exchange. As the TCP/IP based local area networks (LANs) started to appear within the Texas Medical Center (TMC), the University of Texas Office of Telecommunication provided links for these LANs to become integrated within the Internet. This access

allows the same protocols for information sharing that were being used locally to be used world-wide.

With several existing LANs and wide area networks (WANs) on campus and the promise of more soon, it was obvious that there was a demand by students, faculty and staff for Internet access. A number of administrators and users were realizing the feasibility and convenience of "posting" document on the Internet rather than dispersing the information using traditional methods. Thus, the idea of implementing a campus wide information system (CWIS) emerged.

To meet the immediate demand for the distribution of ASCII based documents, an in-house developed system was put in place. This home-grown CWIS consisted of script files forming a menu based system. The system was accessible only through terminal access either via an anonymous telnet session or dial-up phone lines. The menus and associated processes were "hard coded" using Unix script commands and were not standardized. Protocols such as FTP, REXEC and NFS were driven by script or C programs to automatically obtain information from other Internet nodes for incorporation into ASCII files for distribution. However, no attempts were made to integrate the UTH-HSC CWIS, as a whole, with other campus systems.

The initial CWIS clearly demonstrated to the campus community that a distribution system that primarily delivered ASCII text had valuable potential. In particular, it was recognized that (1) users would always know where to look for information, (2) desired information could be accessed from any Internet node, (3) updated information would be immediately available, and (4) publication costs would be drastically reduced. Although these strong points were appreciated, the system definitely had shortcomings. It suffered in that (1) it could not be efficiently maintained, (2) it did not adhere to a user interface that was standard for similar information systems, (3) its existence was not readily visible to the world, (4) it provided no standard method to transparently access other functionally similar information resources, and (5) it was not a client/server based system that coupled the resources of personal computers with those of information servers.

As these advantages and limitations were being considered, the Wide Area Information Service (WAIS) system was developed by Thinking Machines Corporation, Dow Jones & Co., Apple Computer, and KPMG Peat Marwick. This client/server based system permits clients on both personal

and larger computers to access text, images, voice or formatted documents located on WAIS servers. As a searching tool, WAIS makes finding relevant text in a document simplistic. For instance, if you were to traditionally search a book to determine if it contained information on a specific subject, you would search the title, table of contents and the index. Through this search, you may or may not find the one term, obscure or not, that you wish to locate. If this same text is indexed into a WAIS database, the WAIS search engine and not the researcher does the work. The WAIS indexing process categorizes the words and makes all words of the entire text accessible for search, with exclusion of articles, conjunctions, etc. Combinations of words can even be used. In cases where phrases are submitted for search, the WAIS search engine responds with as close a match to the entire phrase as it is able to make then lists all references that contains each of the individual words. On some clients, the search terms are highlighted in the text. WAIS is used for searching all types of text: phone books (where you can search for references by first name as well as last name, or phone number or city, etc); or large text documents (where you can search for any word or phrase in the document).

While WAIS is an excellent tool for searching if you are looking for specific data, the system of WAIS servers also has weaknesses. For example, the list of WAIS sources has grown by leaps and bounds. Although there is a list of registered sources, no hierarchial menu exists that groups the sources by subject. Also, you cannot just peruse the text without first trying a word search. If you just want to read a small portion of the text, WAIS is not the tool to use. But, if you want to search a 300 page book to see where the animal "ferret" is referenced as a laboratory animal, WAIS will deliver a detailed list quickly and accurately.

For the University, WAIS became a dynamic tool. The university office of Information Services along with Human Resources and Employee Relations pulls together information on all employees including: names, departments, home and work addresses, phone numbers etc. This information used with the WAIS tool allows anyone with Internet access to search Centrex, the campus phone book to locate an employee or employees by name or other descriptive information. The Office of Research Services gathers information on all active labs, the research being done, papers written, animals and chemical used, etc. and compiles this information into the Catalog of Research Expertise. With the WAIS system, researchers on or off campus could find

UTH-HSC labs working with any variety of chemicals, techniques or animals. The Purchasing and Receiving Departments have used a similar process to help researchers and staff locate hazardous material numbers. This is just a few examples of where the WAIS system has demonstrated its usefulness at the Health Science Center.

As a stand alone system; however, WAIS does not provide a basic, integrated CWIS system. In particular, the protocol does not provide for a standard user interface that appropriately organizes documents and services in an hierarchical manner that can readily be perused according to subject. The protocol also does not specify a standard, intuitive method for adding available sources to WAIS clients. In order to partially resolve these problems, text and X-window based WAIS clients were implemented on the host supporting our initial CWIS. This approach allowed users to be directed by the CWIS menus to appropriate WAIS sources. However, this approach negated the important advantages associated with having clients running on personal computers so that information is directly and transparently delivered to the desk top.

Since the demand for a more functional, expanded CWIS continued to grow, we systematically began to investigate the efforts of other universities and groups to develop a standard CWIS protocol. As a result of this investigation, it was concluded that the Gopher Protocol for document distribution developed by the University of Minnesota would be used to implement a new CWIS for the Health Science Center. This protocol was selected for a number of reasons. For one, users see the world-wide networked system of Gopher servers as a single hierarchical system of documents, directories, full-text search tools and other services. Secondly, it is a client/server based system that enables users to easily and transparently access servers anywhere on the Internet and functionally transfer data to their personal workstations. Thirdly, it incorporates a well defined set of standards for defining data types, establishing connections between servers, transferring data, linking menu entries to data files, etc. Fourth, it is becoming a de facto standard for universities and other organizations that utilize the Internet for the rapid exchange of digital information. Lastly, Gopher is a recommended protocol for document distribution within the NSF Implementation Plan for Interagency Interim NREN.

Our Gopher based CWIS was activated in March, 1992. Users were immediately impressed with the systems ease of use and simplistic design. Gopher requires virtually no

training for access or use of the system. One of its best selling points is its connectivity. Gopher servers, once listed by the Minnesota Gopher, are all capable of being interconnected. To move from one Gopher server to another, the user merely chooses a different topic. The addressing and other connectivity issues are all invisible to the user. It is as though any information available via ANY Gopher server resides on the user's personal computer. Files can be mailed, saved to disk, or printed by an average user, without training.

The conversion of the CWIS at UTH-HSC to Gopher necessitated the creation of an editorial staff and new document publishing tools. The staff consists of an editor in chief that oversees all work. Other staff members have responsibility for various pieces of the whole. It is imperative that the group work as a team, rather than holding tightly to their own piece of the pie. Our experience confirms that of Art. St. George, Executive Network Services Officer, at the University of New Mexico, that the editor in chief should not be a programmer, but rather a "people" person. This helps negate the possibility that the end product is only geared toward computer proficient users. The CWIS must be easy to use and attract non-traditional computer users. In addition to the editor, the team should include a programmer and a design consultant. With such a team, the end product will be useable, effective and aesthetic.

The editorial staff has several responsibilities. One of the primary responsibilities is to maintain a state of the art electronic publishing environment. This requires the staff to evaluate and implement: (1) document distribution protocols; (2) publishing servers; and (3) reader clients. When required, appropriate software tools to support publishing activities must also be developed.

A second responsibility is the layout and production of the CWIS. This includes assisting the information owners in defining appropriate text for distribution, as well as, the menu and submenu categories. When campus groups become interested in publishing new information on the CWIS, some editing requirements are necessary. While we agree to hand-hold the information providers in formatting the documents for publication, it is important to note that the responsibility for producing ASCII documents lies in their hands, not the OAC staff's. A list of the standards that we have set are below, along with the reason for each of these standards.

* Avoid the use of tabs, instead use spaces. Reason: ASCII tabs are not converted to a constant number of spaces by all display devices. Thus, the use of ASCII tabs often causes text to be displayed in a jumbled fashion.

* Delete bullets or other special symbols such as Greek characters and/or replace with standard ASCII characters. Reason: Character based terminals can only display ASCII symbols.

* Single spacing of lines, but double spacing between paragraphs. Reason: Maximizes the amount to text that can be displayed per screen while preserving readability.

* Use a non-proportional font and limit line length to a maximum of 78 characters per line. Reason: If all characters do not take the same amount of space, it is difficult to ascertain whether each line has less than 80 characters or not. Lines that exceed the 80 character limit will either wrap improperly or run off the screen. If each letter takes up the same amount of space, the problem of wrapping lines or lines running off the page are avoided.

* Place headings in capital letters and text in up/down casing. Reason: Enhances the identification of the beginnings of thoughts and divisions of chapters, sub-chapters, etc.

* Place identifiers around headings (dashes or equal signs). Reason: Enhances the conceptual readability of the material.

* Prepare text in a neat, orderly and easy to read format for both paper and electronic formats. Reason: For first drafts we suggest submitting both a hard copy and an electronic copy in case there are errors in the formatting.

* Place a line of 50 dashes before each section of material if the denoted sections are to be indexed into a WAIS source as separate documents. Reason: The WAIS indexing tool can be configured to use dashes instead of other delimiters, such as blank lines, to identify where WAIS documents are to start and end.

When ASCII documents are appropriately formatted, the editorial staff assists in creating or modifying existing

menus and assigning menu ownership. Owners of information are often provided with appropriate tools that enable them to self-publish their material via the CWIS.
If necessary, the staff will enter the information for the owner until tools can be created.

The editorial staff is also responsible for monitoring the overall look-and-feel of the CWIS. These activities include (1) confirming that menu pointers to remote information sources remain functional, (2) ensuring the general availability and timeliness of documents, (3) checking the functionality of WAIS sources, and (4) guaranteeing the adherence to certain basic standards. These standards include conformance to the formatting guidelines for ASCII text, the inclusion of ownership information within documents, conformance to copyright law, and the general readability of documents.

It is also important to realize that the editorial staff must assume certain public relations responsibilities. The "reader" base must be expanded by advertising, assisting users, analyzing usage trends and responding to user suggestions. The publishing service must also be actively promoted by contacting possible information providers, demonstrating both user and publishing aspects to various individuals and responding to queries about the publishing capabilities of the CWIS.

Publishing tools have been developed to enable users to directly publish information from either their desktops or from mainframe hosts. One of our publishing tools is called "mailman." Mailman was developed to permit users to publish ASCII documents directly via e-mail. The process begins when a document is created for publication. Before publishing, the document must be converted to ASCII format. Then, it can be mailed to the user "gopher" (or another specified userid) on a computer that is running the Gopher server daemon. (A deamon is a utility program that runs in background on the server awaiting queries from Gopher clients.) Mail received by the host that is addressed to this designated userid is sent to the "mailman" program. The "mailman" checks to determine if the person sending the message from that particular host is in a list of approved user/host pairs that has permission to remotely publish information. If the userid@host.domain is included on this list, "mailman" checks the subject field of the message to determine where in the hierarchial Gopher system the information is to be placed. In other words, the Mailman program checks to see that the userid, host.domain name and subject heading all match. If all checks out, the ASCII file is published. As an added security for quality work, Mailman then sends e-mail to the editor of the CWIS, with

information on which files have been updated. This will allow for checking of quality and format. A diagram of this process is shown in Figure 1.

A second publishing tool was produced to deliver information from mainframe computers. This tool allows for direct and automatic publishing. When a report is generated, either at set intervals or upon demand, they are converted to ASCII text files from the appropriate data bases located on the mainframe computer. The ASCII file is then retrieved by a Unix based computer using the FTP protocol. Once on the Unix server, the MakeWAIS tool indexes the data into a full-text WAIS source. Like all WAIS servers, the file is now completely searchable.

When WAIS creates a WAIS server, the program produces several files. These files need to be moved to proper areas in the Gopher client. The MakeWAIS tool moves all of these files. If the information becomes obsolete, the CleanWAIS tool retrieves all of the various files for that database and removes them from the system. This process is illustrated in Figure 2.

As the system develops, new tools will need to be created in order to help users publish with ease. It is our opinion that any new tool that requires an entire pamphlet of instructions, should never be given to a user, but rather filed away in file 13. The elegance of the Gopher protocol is a model of ease and useability that should be copied. In Figure 3, you will see that several groups are now providing information through Gopher servers to the UTH-HSC. These interconnected servers maximize the amount of information made available to our users with distributed workloads. No one group need provide all information, nor is it necessary to reproduce the work of others with the Gopher client makes pointing to other sources such an ease.

The Campus Wide Information System at UTH-HSC changes daily and will continue to do so. That is an asset.

Using E-mail for Direct Publishing

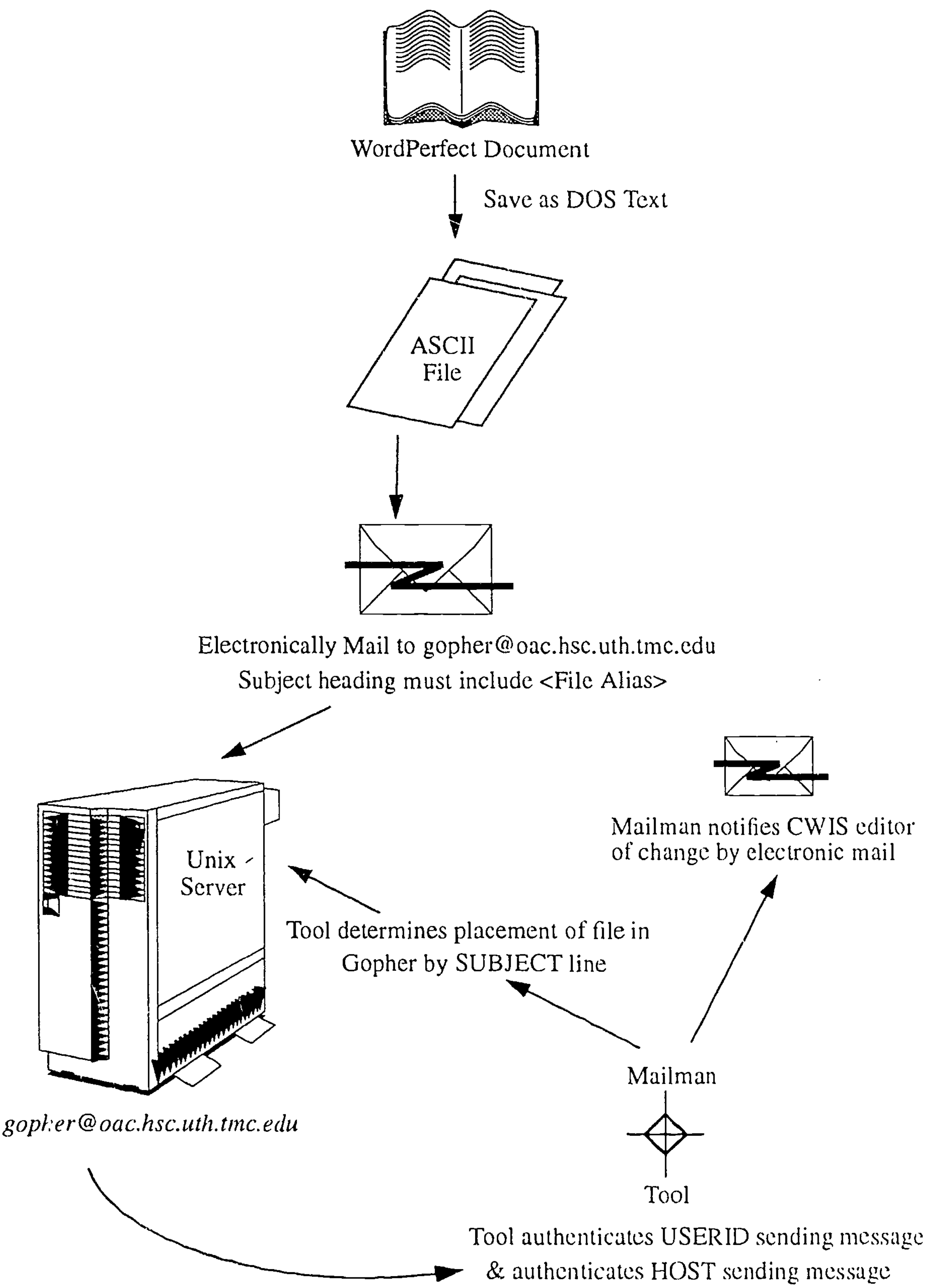

Figure 1
OAC 1992

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Integrating Mainframe Data into the Campus Wide Information System

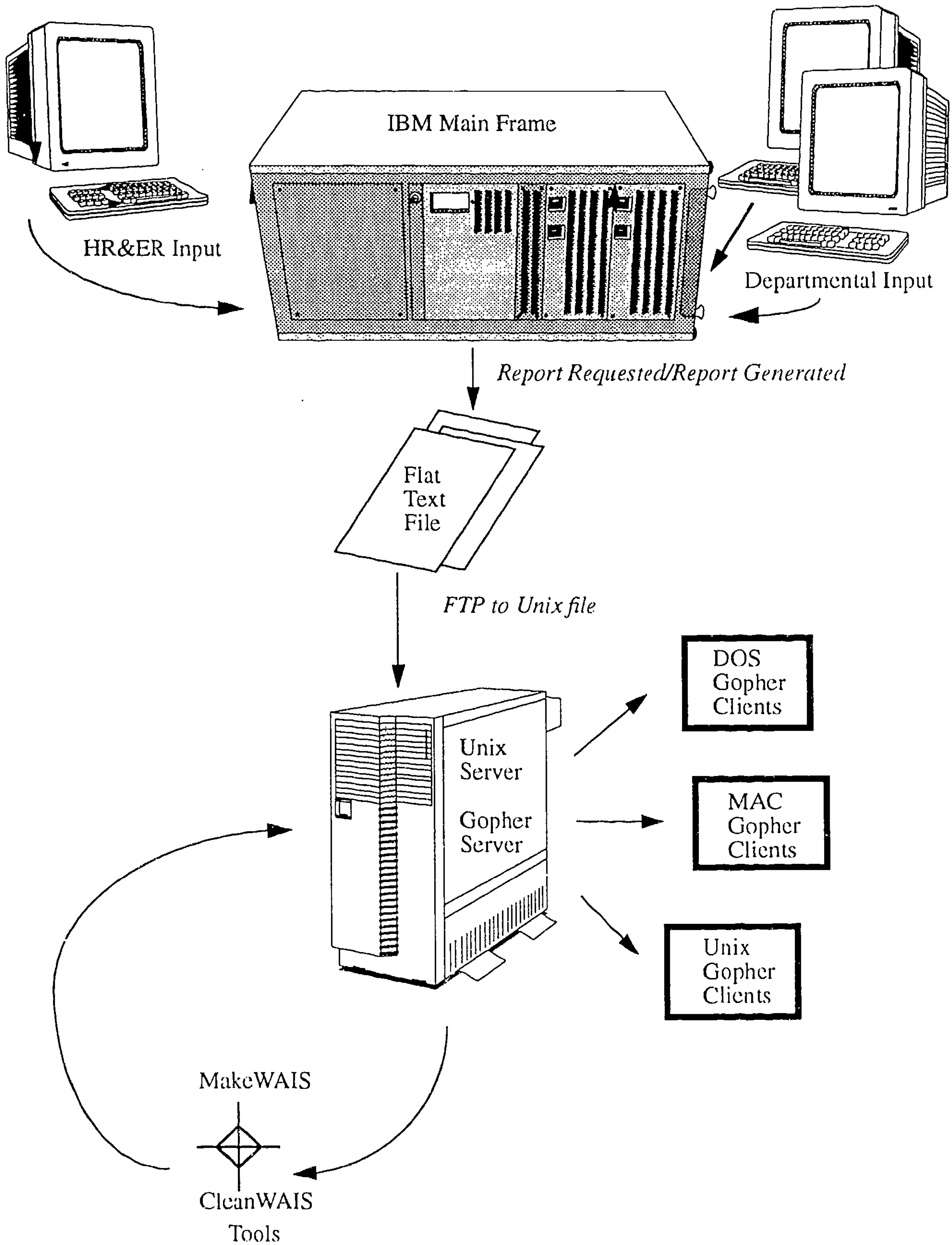

Figure 2
OAC 1992

The University of Texas at Houston
Health Science Center
Campus Wide Information System

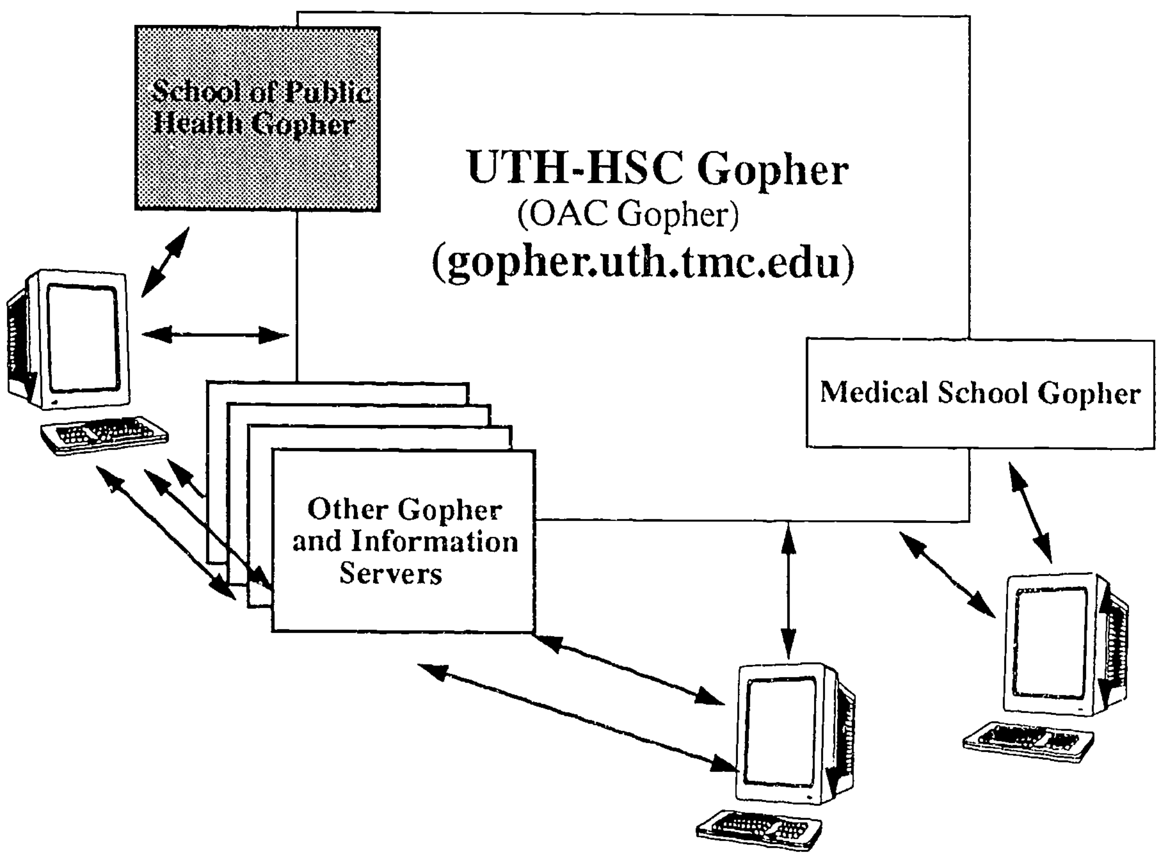

Figure 3
OAC 1992

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CUMREC
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San Antonio

INFORMATION TECHNOLOGY: The Revolution Continues

INFORMATION RESOURCES MANAGEMENT

T2-4

Three Steps Toward Distributed Data Access: DATA, TOOLS and TRAINING

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Three Steps Toward Distributed Data Access:

DATA, TOOLS and TRAINING

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INTRODUCTION

This paper presents the three steps Administrative Information Services (AIS) is following to provide Michigan State University's clients with a new data access architecture. This architecture will be comprised of comprehensive data reporting structures, non-mainframe database software with user-friendly tools, and training on both tool use and the meaning, format and location of reporting data. Our strategy can be described with three key words: *data, tools* and *training*. Due to the phased implementation and sheer size of MSU's new Student Information System (SIS), we have taken a "data first" approach. Flat-file extracts of selected portions of the database have been created for use in our current Client Based Computing environment and training on these extracts for MSU's administrative units has been completed. The growing sophistication of our clients' computing requirements, the proliferation of campus and local area networks, and the power of the desktop workstation are the driving forces behind our final goal which is to move these extract files to an alternate platform for client access.

BACKGROUND

Michigan State University was established in 1855 as the nation's first land grant institution. Located in East Lansing, MSU's park-like campus encompasses 5,200 acres and includes nearly 150 buildings. The University has an enrollment of about 40,000 students in undergraduate, graduate and professional degree programs.

Administrative Information Services (AIS) reports organizationally to the Vice Provost for Computing and Technology. The mission of AIS is to provide leadership in the administrative use of information technology capabilities that contribute to the University's mission of teaching, research and service.

Administrative Information Services' 150 employees serve administrative support and academic administration units and their constituencies, faculty and staff, students and other organizations that contribute to the University's mission. The AIS Data Center houses an IBM 3090 model 300J processor running MVS/ESA. AIS utilizes both IDMS/DC and CICS for administrative application software access.

"End User Computing" at Michigan State University is referred to as *Client Based Computing (CBC)*. MSU has a large and active CBC community: more than 200 individuals have been trained in mainframe-based reporting languages such as SAS and DYL 280 II. Client programs are created and submitted through the ISPF-like editor SYSD accessible through CICS. Job and program outputs are reviewed prior to print through the use of SAR which is made available at the VTAM menu level. The MSU CBC community executes in excess of 87,000 batch jobs per year on the AIS mainframe. In addition to these *ad hoc* queries, clients create programs for regular execution as part of the daily batch production schedule.

CBC "beyond the mainframe environment" describes a large and rapidly growing demand for information delivered to alternate platforms for local processing. Recent years have seen tremendous growth in the campus Ethernet network, local area networks and desktop workstations.

AIS' challenge to support our clients and their requirements to have information available in a timely manner and in an easy-to-use format is being met by concentrating on three fronts:

- First, ***data*** must be available to support a variety of reporting needs and must be accessible yet protected from unauthorized access;
- Second, ***tools*** must be provided which serve the needs of our most sophisticated clients as well as the needs of infrequent and/or less skilled users;
- And third, ***training*** on both the tools and the meaning, format and location of data must be provided.

The following sections describe the catalyst that launched our search for creative solutions to address these issues as well as our progress to date and future plans for each of the three steps.

THE MSU STUDENT INFORMATION SYSTEM: A NEED FOR CHANGE

Michigan State University has recently completed the initial replacement of its collection of isolated student record applications with a comprehensive and highly integrated Student Information System (SIS). SIS encompasses Admissions, Enrollment and Registration, Financial Assistance, Financial Records and Academic History. The software base consists of SCT and SIGMA packages which have been customized to meet MSU's requirements. SIS is made up of 615 online maps, 853 ADS/O dialogs and 550 batch jobs.

In implementing SIS, the University is moving from a series of application specific files with a variety of file structures and organizations which are very familiar to our clients to a complex CA-IDMS network database consisting of 457 record types, 11,000 data items and 718 physical record relationships (sets). The database, which has not reached its ultimate size, currently consumes 37 gigabytes of DASD storage.

Due to the complexity and size of the new database, direct access by clients is untenable. Not only would most of our clients find the database navigation required to satisfy their reporting needs too difficult, the sheer volume of records which would be read would cause resource contention problems for the online application. Add to these concerns the fact that much of the data is stored in an encoded format and that many of the student classification structures have been changed with the new system.

SIS DATA ACCESS SERVICES (DAS)

In an effort to pro-actively address the difficult client computing issues raised by the implementation of SIS, MSU created the SIS Data Access Services (DAS) function within Administrative Information Services. This function's charter is to define, articulate, and advocate a coherent SIS data access strategy.

The primary goals and objectives of the SIS Data Access Strategy are:

- To isolate the client programmer from navigation of the complex and voluminous SIS database by creating host-based SIS reporting data resources;
- To position SIS reporting data resources for future client/server or distributed database applications;
- To provide tools which allow for routine or recurring retrieval requests to be met effectively and efficiently;

- And to foster, encourage and enable a greater degree of client independence through a strong program of education and support.

The SIS Data Access Services team is staffed with four permanent positions, one graduate assistant, and two student programmers. The team is supervised by a Senior Systems Analyst. Permanent staff includes one Systems Analyst and two Programmer/Analysts. Students are employed at half-time.

Organizationally, the SIS DAS Manager reports to the AIS Student Information Systems Manager who also carries the title of SIS Project Assistant Director. This position reports jointly to the SIS Project Director and to the AIS Assistant Director of Information Systems and Services. Like AIS, the SIS Project reports to the Vice Provost for Computing and Technology.

The Data Access Services team works closely with the University Data Resource Administrator, the SIS Project Team, and several areas within Administrative Information Services: access to client extracts is controlled through Security Administration; Database Administration provides assistance with IDMS retrieval, subschema development and extract performance issues; and client computing performance, tool and environment issues are managed by Help and Support Services.

MSU/SIS: THREE STEPS TOWARD DISTRIBUTED DATA ACCESS

The Student Information System is a very large application and affects every office across campus which interacts with students. As may be expected of a project of this scope, SIS has been implemented in phases over the past two years. Our clients however, could not simply stop and wait for AIS and the SIS project team to design new reporting files or to select and implement new non-mainframe database software and tools. Their work had to proceed uninterrupted as each new phase of the application was moved into production.

STEP ONE: THE DATA

A project to establish a distributed computing environment at MSU is officially just beginning. Due to the circumstances of the SIS project, MSU has taken a "data first" approach to providing this environment. Since its inception, SIS Data Access Services has been working toward the long-range goal of re-engineering selected data from the SIS network into a relational format more suitable for reporting.

A lack of vendor supplied reports requires that a large number of operational reports be produced by client staff through the CBC environment. Thus, each of the project phases required that data converted to SIS be made immediately available to CBC. Without initially taking a general approach to data resource design, project phasing and the requirement for immediate access to SIS data would have combined to create a patchwork of single-function data resources.

Effective data resource definition and design is a highly cooperative venture involving the University Data Resources Administrator (DRA), representative client offices, SIS project team members, and SIS Data Access Services staff. Early and persistent involvement of client office managers and programmers is key to developing a sense of client ownership of the data resource.

Data resource design begins with data analysis. The first phase of this analysis was to review how key client offices such as Registrar, Admissions, Financial Aids, Controller and Institutional Research were using the pre-SIS systems' data for reporting and analysis. Additionally, discussions were held with project team members and client office staff to determine how the new application's data might be used for production reporting, interfaces and client computing. Data analysis activities led to the conclusion that while a subset of the database population would suffice for reporting, a subset of the database content would not. DAS subsequently concentrated on pulling most of the data elements on the database into extract files. This was done by basically "de-normalizing" the SIS physical database into logical entities in order to create a logical model.

Client-driven data resource design followed the creation of that logical model. Client Design Workshops were held involving a large group including DAS, the DRA, SIS project team members and most importantly, client programmers and managers. Workshops were scheduled to include between three and six four-hour sessions.

At the workshop sessions, the logical model and attribute list were discussed at length among workshop participants at a pace which allowed all involved to reach a common level of understanding. Workshop discussions were centered around relational design techniques such as the resolution of repeating groups, the identification of primary and foreign keys, the review of controlled redundancies, and the determination of the operational population.

Due to the extraordinary volume of the SIS database, extraction of the entire database population on a daily basis for reporting is not feasible. Rather, SIS DAS has endeavored to identify and isolate the subset of the database which represents the operational layer of the data. At MSU, data collected over the past two years is adequate for the vast majority of reporting requirements. Institutional research and specialized longitudinal, retention and trend analysis reports require the use of a wider span of data. For these purposes, a twenty year history of activity is extracted to tape on an infrequent basis. These types of studies can also utilize data frozen to tape for official reporting purposes. These database snapshots are taken each semester at specific times such as close of registration, first quarter of semester and end of semester.

SIS is largely driven by tables and encoded data values. While making the online system highly flexible and responsive to institutional change, accurate reporting from familiar flat-file structures is infeasible. SIS employs in excess of 100 tables of data and related processing flags. To address this situation, SIS tables are extracted daily and stored together in a direct access VSAM file. Clients have been trained in specifying table number and table key values when accessing the file for table data. Once VSAM processing had been introduced to CBC with support and training established, other uses for direct access could be considered. Several key files have since been created with both sequential and VSAM versions in order to provide multiple navigation paths through the "relational table" extract file structures.

The consensus of the clients on the designs of the reporting extracts was critical. We also believe that the SIS reporting data resources meet the original goals and objectives set forth, including effectively positioning the data resources to move to the distributed computing environment without additional design or revision.

STEP TWO: THE TOOLS

During the phased implementation of SIS, it has been imperative that clients be able to continue using those programming tools and techniques that have been available to them for years. Due to significant changes to the types and formats of the student data being stored, it is not possible to "backload" all the familiar files that were the outputs of our older non-integrated systems. However, by training the clients in the new data available on the extract files, they have been able to make a reasonably rapid transition to the new data environment. Similarly, several clients, who over the last several years have been able to download information to their desktop workstations, are able to continue this activity after training on the data.

One objective of SIS Data Access Services is to provide data manipulation tools which allow for routine or recurring student information retrieval requests to be met effectively and efficiently. Significant data activity analysis revealed that a very large percentage of requests for student information could be met through a relatively limited number of standardized retrieval utility programs.

Today, ten utility programs have been developed to produce listings, labels or files for data transfer. Files can take the form of tape, diskette or FTP transfer datasets. These ten utility programs have virtually replaced over 800 centrally maintained "recurring request" programs which manipulated old student systems data for lists, labels and tapes. While specifically designed to support academic unit processing, the utility programs have also proven useful for providing information to campus groups and third-party organizations outside the University.

A new project, a cooperative effort of AIS and the Computer Laboratory (academic/research computing), is using existing staff and hardware/software resources in a "proof of concept" pilot for a new reporting architecture. The goal of this project is to load selected SIS extract data to a Sybase database currently available in the Computer Laboratory. The project will incrementally develop from a server-based reporting model of minor complexity to a client/server model loaded with somewhat more complex data structures. This project will serve to highlight the issues and challenges which we will face as we begin evaluating hardware platforms and supporting database and reporting software to support campus wide access to SIS data.

As we begin our evaluation of the optimal hardware platform, database server and reporting tools, we have the following objectives. First, SQL-based reporting tools should be independent of the database chosen. Second, the database should be independent of the operating systems of the wide assortment of desktop computing workstations already in place across the MSU campus. Finally, the operating systems should be independent of the hardware platforms. These objectives are simplified and are perhaps overly idealistic. However, the more "open" the various components are, the greater the likelihood that our clients will be successful working within the new reporting environment and that AIS will be able to provide the support that they need.

Moving much of the client data access activities to a non-mainframe platform will allow our clients to utilize powerful PC-based tools. Plus, since the hours of availability of the mainframe (normally 7:00 a.m. to 6:00 p.m., Monday through Friday with some weekend hours when possible) may not meet the needs of client offices who often work outside normal business hours, the availability of alternate computing platforms should be much more flexible.

STEP THREE: TRAINING

One key objective of SIS Data Access Services is to enable a greater degree of client independence through a strong program of education and support. Extensive encoding of data in SIS creates a vastly different programming challenge than was the case with the "old" student systems. In addition, classification structures such as *level, curriculum,* and *major* changed significantly in both meaning and use. These factors combine to forever change the "language" of student data and reporting at MSU.

Three elements make up the essence of the SIS data resources training and support program: metadata documentation; classroom experience; and on-going customer service and support. In addition to the training and support program, frequent informal contacts with active clients is an important element of maintaining client confidence in the SIS reporting data resources. Consistent, informal client "account management" is also important for managing client expectations and for minimizing client crisis situations.

- *Metadata,* or data about data, is an area of extreme importance. Clients must have documentation in order to successfully and fully utilize the SIS reporting data resources. Documentation created to date includes a client data resource reference guide. The reference guide includes file layouts, file summary information and navigation paths through various extract files.

- *File layouts* include element name, size and type along with a brief description of the meaning of the element. Additionally, fields which can be used as foreign keys to other extract files are marked. This includes code fields which can be expanded through accessing the common SIS table file (VSAM).

- *File summary information* includes dataset name, record length, recommended blocksize and file size information in terms of the number of records normally in the file. In addition, if both sequential and VSAM versions exist, this is noted in the file summary information. Any special programming considerations or processing tips are also documented here.

- *Navigation paths* from extract files to the table file and between extract files are also documented for client programmer use. Navigation path diagrams resemble entity-relationship diagrams with foreign key relationships highlighted. The client data resource reference guide is distributed to client programmers as they attend training sessions.

Future documentation directions include placing the data resources reference guide into a shareable medium. The development of a comprehensive data "encyclopedia" is seen as a primary requirement as we augment SIS metadata documentation. DAS research has indicated that an interactive encyclopedia, with a place for client comments and tips, is an important goal.

Classroom experience currently utilizes the lecture / lab approach common to technical training. Training has been focused to date on central support offices and has followed the phasing of the SIS implementation. As phase-related extracts are implemented, key client offices are trained in the format and use of the data. Classroom sessions have been videotaped to allow for repetition without convening a full class.

An academic unit training initiative is beginning which will provide training and documentation to currently active academic CBC programmers. DYL 280 II and SAS language training courses are currently being tailored for the academic community, focusing on the language components required for successful SIS-related computing. A future training initiative will be to convert training materials to a more interactive and selective platform. Hypercard will be investigated as a means to deliver high-quality training on specific topic areas or data issues.

Academic or support units wishing to establish a CBC function, or wishing information about SIS reporting in general, can request a SIS Reporting Consultation. DAS staff consult with the unit on available SIS reporting options including establishing or expanding the CBC function within the unit. A training curriculum is recommended to include language or tool training, SIS online training and SIS data resources training. Further, assistance can be provided in the search for and selection of unit CBC staff.

AIS Help and Support Services provides an important component of client support. The Help and Support Center can be reached through phone or campus electronic mail. First-level support, problem logging, and problem tracking are the essential services of the Help and Support Center. SIS DAS provides second-level or expert support on referrals from the AIS Help and Support Center.

While data resource training has been established, tool related training will be required once the distributed computing project reaches the point of implementing selected platform and software solutions. Help and Support Services staff are represented on the distributed computing project in order to develop expertise prior to the need to deliver day-to-day support of the tools and data of the distributed computing environment.

We have discovered that training and support can be more effective by involving client staff and managers in every step of the project. Frequent client involvement through design workshops, formal client meetings, and informal client "account management" can build a sense of ownership and intensify client participation in training activities.

CONCLUSIONS AND THE FUTURE

By concentrating on creating general purpose data extracts, we have been able to avoid creating a multitude of unrelated reporting files specific to a particular client's requirements. The physical structure of our extract files also positions us to be able to move data to a new platform and database management system at any time. In addition, training clients on the uses, meaning and location of data within the existing environment should make a transition to new tools on a different platform somewhat less traumatic. An unexpected bonus of delaying the search for non-mainframe database software and tools has been that the market has had a chance to mature. Vendors are announcing more "open" versions of their software and this trend is expected to continue. Since MSU has such a heterogeneous mixture of networks and desktop workstations, this delay will probably make it cheaper and easier to supply hardware and software solutions that will work across the entire campus.

We believe that success with a distributed database reporting architecture for SIS clients will allow us to expand this service to other clients who currently work with Human Resources, Financial, Budget and Alumni Development data which is still available only through the AIS mainframe. Indeed, these clients currently submit many more CBC jobs than our major SIS clients. Today, even though SIS has not been implemented in its entirety and not all potential clients are accessing the system and/or data extracts, CBC jobs on the mainframe sometimes suffer from throughput that is less than ideal. Certainly, this is not in the best interests of our clients: our goal is to provide the information they need as quickly as possible.

We also hope to provide the same types of documentation and training for current applications to our non-SIS clients and to introduce those clients to new tools on alternate platforms which will allow them to increase their productivity and effectiveness. How we structure AIS to accomplish these goals is currently under discussion. For now, we are concentrating on the Student Information System's data resources, on its reporting and manipulation tools, and on ongoing client training and support.

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INFORMATION RESOURCES MANAGEMENT

T4-4

Implementing Data Administration and Strategic Data Planning at the University of Michigan

Renee Woodten Frost
John Gohsman
University of Michigan

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Computer Users Conference

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Implementing Data Administration and Strategic Data Planning at the University of Michigan

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Rapid technological changes are creating many challenges for information systems organizations. One of the most pressing of these challenges is responding to and supporting the growing number of users who have the technology and who want to provide and to retrieve increasing amounts of institutional data for performing business functions and for decision support. An important role for information systems organizations is to provide a framework and guidelines that will serve the diverse and expanding needs of these sophisticated users.

Data--the raw material for this new information age--must be formally managed as are other institutional resources such as people, finances, and facilities. Data accuracy, consistency, and reliability need to be ensured. Data also becomes the key to integrating future systems. The University of Michigan University Information Systems (UIS) has proactively adopted a data orientation toward its development of systems and its long-term systems planning. UIS established a Data Administration function to provide guidelines for some immediate assistance to users and to provide a long-term planning approach for integrating data and systems and mapping them to University goals and objectives. This paper provides an overview of the establishment of this Data Administration function and its components, followed by a more in-depth presentation of the long-term Strategic Data Planning process underway.

Data Administration

Technological changes affect the way systems are developed and implemented. More users at various levels of the organization are now involved in the development and use of new applications because technology is driving the distribution of data and processes, and information is being used increasingly as a competitive tool. Technology is, in effect, increasing our institution's appetite for data. This has resulted in a heightened need to enhance the accessibility, integrity, and usefulness of the institutional data and to promote the view of information management oriented to data as an integrated University resource rather than one that focuses on separate departmental processes.

To establish credibility for a data administration function, an institution must recognize the problems data administration can solve or the benefits it can provide. At the University of Michigan, it was a combination of both that led UIS to create its Data Administration group.

Specific data-related problems that currently face the University of Michigan, as well as many other institutions and corporations, include:

- Interfaces and extracts which causes timing delays and loss of currency,
- Redundant data entry,
- Redundant data which is unplanned and unmanaged,
- Diminished data integrity,
- Inflexible systems,
- Restrictions on information sharing which were unwanted and unplanned,
- Lack of common, global understanding of information, and
- Inconsistencies in definition and content of data.

Benefits of a data administration function to an institution vary depending on the audience. The following benefits are separated into four categories:

- General audience:
  - Maximize or reengineer business processes by reusing data,
  - Result in flexible systems since systems are based on an institution-wide data model,
  - Result in maintainable systems, and,
  - Promote controlled redundancy.
- Information Systems management and staff:
  - Reduce politics in projects (common definition of business from a data perspective),
  - Escape from the maintenance quagmire, and
  - Establish data as a foundation (data tends to be more stable than procedures).
- Middle management:
  - Enable sharing of data,
  - Reduce political barriers, and
  - Eliminate technology-related business difficulties within daily work routine.
- Executive management:
  - Achieve competitive advantage,
  - Maintain and promote growth,
  - Support better product or service offerings, and
  - Improve quality.

Data Administration at the University of Michigan

Many factors contributed to motivating the University of Michigan to establish a data administration function: the strategic decision to establish a data orientation for information systems, the anticipation of distributed computing environments, the development of systems in relational database format, and especially, recognition by our users of the importance of data integrity and consistency during our Data Access Project. The Data Access Project[1] was created to improve end-user access to institutional data. The first report from the Data Access Project recommended "establishing a Data Administration function." The report stated that this function was critical to the success of making institutional data more readily available. The report also stated that data must be managed across all institutional systems to ensure consistency and common definitions, that Data Administration must develop effective liaisons and communications with user groups, that Data Administration must develop an institutional data model, and that Data Administration must develop a standard format for data dictionaries. This report from the Data Access Project, the first to focus solely on data access, summarized the problems with accessing data and made specific recommendations on how to address some of the problems.

[1] Bennett, Peggy, Improving Access to Corporate Data: Users Remain Partners in Experimentation, (CUMREC Proceedings, 1992)

The Data Administration group was established within University Information Systems in November 1990 and has grown to include three data analysts, an administrative systems/data planner, and a support person.

Every day, a wide variety of data is collected and used to conduct the activities of the University. The philosophy adopted by the University is that data is institutionally more valuable when it is widely and appropriately used. Its value is diminished when it is misused, misinterpreted, or not accessible by people who have a legitimate use for it. This philosophy set the stage for the work of the Data Administration group and contributed to its mission and goals which follow.

Mission:
Data Administration will promote data as any valuable shared resource by creating a data environment for the University of Michigan which will ensure the establishment, maintenance, and delivery of accurate and reliable institutional data.

Goals:
- Recognize and promote the importance of data as a valuable institutional resource.
- Promote data consistency and standardization throughout the University.
- Create a data architecture that supports the informational needs and business functions of the University.
- Minimize duplication in capturing, storing, and maintaining data.
- Encourage and facilitate data access and data sharing.
- Improve the quality, accuracy, and integrity of institutional data resources.
- Improve data management and access through the use of appropriate methods, tools, and techniques.
- Promote the use of the data resource in support of University decision making and strategic planning.

Data is a resource and should be managed as a resource. Managing any resource includes addressing the following life cycle stages:
1. Plan for the resource.
2. Acquire or create the resource.
3. Maintain the resource.
4. Use or exploit the resource.
5. Dispose of the resource.

The Data Administration group in University Information Systems (UIS) is developing and applying a set of formal rules and methods to manage the University's data resources and maximize their value. Data Administration is concerned with those data resources that are critical to the administrative functions of the University, regardless of whether the data is used or maintained by administrative, academic, or Hospital clinical/patient care units.

Although administrative data may be stored in different database management systems and in different physical locations, all of it can be thought of as forming a single "logical" database, called the "institutional database." This terminology does not mean that information should reside in a single physical database. It means that no matter where the data is, the same principles of data management should apply to maintain the value of the data and ensure that it is used effectively.

If a data element satisfies one or more of the following criteria, it is considered institutional data at the University and therefore, part of the institutional database:

- A University administrative or academic unit needs it for an administrative or clerical function--functions such as planning, managing, operating, controlling, or auditing.
- It is generated as a result of clinical or patient care activities.
- It is generally used by more than one organizational unit. (Data elements used by a single department or office typically are not considered part of the University's institutional database.)
- It is included in an official University administrative report.
- It is used to derive another data element that meets any of the other three criteria in this list.

Data Administration at the University of Michigan includes four essential aspects of managing this institutional data: data planning, data standards, systems development support, and data accessibility.

Data Planning

Managing data resources with an eye to the future requires the definition of a data architecture and a systematic way of planning database applications and systems. Both are underway at the University. Planning is needed to provide a framework in which administrators can objectively determine the scope of each project, decide which projects should be initiated, and determine the order in which they should be developed. Strategic data planning, which is described in more detail later in the paper, is the method the University of Michigan is using to plan for its long-term data and system needs.

A critical component of data planning is a policy and a set of guidelines for managing data resources. The policies and guidelines governing data administration are explained in two documents. Institutional Data Resource Management Policy and Data Administration Guidelines for Institutional Data Resources. These documents were prepared by an ITD/user group building on example documents from both industry and higher education institutions, such as Virginia Tech and Indiana University. Input and revisions to these documents were solicited from major committees and/or individuals in all school/college/administrative units on campus. They have been extremely well received and supported.

On an ongoing basis, Data Administration is responsible for:

- Developing effective liaison and communication with the people who use the data.
- Reconciling conflicts in data definitions.
- Dealing with issues of data ownership, data redundancy, data integrity and accuracy, and data usage.
- Data migration strategies.

Systems Development Support/Data Modeling

For projects involving UIS, a University-customized Systems Development Methodology (SDM) is used to guide the systems development effort. Tasks related to Data Administration are defined in the SDM and include:

- Assisting with project estimates.
- Assisting in new data requirement definition.
- Building a logical model of the data (data modeling is generally considered the most visible service provided by Data Administration).
- Reviews data for use of institutional naming standards for entities and attributes.
- Assists in assigning sensitivity levels to data resources.
- Mapping requirements against vendor models.
- Working with the database administrator on physical database design.

Data Administration services in support of systems development are also available to projects outside of UIS and have been used by developers of departmental systems at UM.

Before a database system is built, the content and structure of the data must be known. Data modeling includes creating and validating a logical data model to collect data requirements prior to building a database system. A data model is an abstract representation of the structure and content of a set of data, independent of any database management system.

To be successful, data modeling requires carefully selecting the designers and system users who will participate in the data modeling session. A data analyst, from Data Administration, trained in data modeling techniques, leads the group through a series of questions and discussions. These data-modeling sessions can last from a few hours to many days. The goal is to create a model with the simplest structure, a structure with the least amount of redundancy. Rather than displaying data relationships built for a specific application, a good model discloses the general nature of the data, allowing for future growth and expansion.

Eventually, Data Administration will consolidate the data models from numerous projects (bottom-up) and the strategic data planning (top-down) to create an institution-wide data model. This model will serve as a map of the institutional data, allowing the University to build new systems that can share accurate and timely data.

Data Standards

Data users face a critical need to merge and analyze data from various administrative information systems to make informed decisions. One way to facilitate this process is through the use of data standards. Data standards comprise the rules for defining, documenting, and naming data. At the University of Michigan, standards are evolving and currently consist of various kinds of recommendations and approved lists, including: guidelines for defining data elements, major classifications of data, standard syntax for naming data, suggested formats for data, approved abbreviations, and guidelines for using and enforcing standards. These were developed in conjunction with data users.

Since institutional data needs to be identified on a University-wide basis, the standards for naming and defining data make data sharing easier and eliminate unintentional redundancy. After data has been identified in data modeling, it is named and defined according to the standards.

Data Accessibility

ITD has begun investigating data-repository software that will store information about U-M institutional data and how it is used. The ideal repository would automate the tasks of searching for data elements and comparing them to one another. The repository would provide a data directory that allows users to search the repository for data elements and identify their physical locations.

Data Administration's goal is to help authorized University users easily access data in the institutional database. Members of the Data Access Project recommended the establishment of a Data Administration group to manage data across all institutional systems to provide consistency and integration. The Data Administration group has been intimately involved in data modeling efforts of the projects as well as with issues of data definition reconciliation, data ownership, data redundancy, data integrity, accuracy, and data usage.

STRATEGIC DATA PLANNING

Definition and Purpose

Strategic data planning means establishing a long-term direction for effectively using information resources to support an institution's goals and objectives. As the University of Michigan continues to review its investment in and reliance on information technology, it has implemented "strategic data planning" to build an institution-wide data model and to create an administrative information systems plan that supports University goals and objectives.

The term "strategic data planning" is something of a misnomer. While such planning strongly emphasizes defining data requirements, it gives equal attention to how the University functions. Strategic data planning stresses looking at how the University functions rather than how it is currently organized. It is concerned with what the University wants to accomplish in the future, rather than who is or should be doing it, or how it will be accomplished. Strategic data planning tries to answer the following questions:

- What business are we in?
- What things must we manage to conduct this business?
- What data do we require to manage those things?

With this information, the University can develop an institution-wide data model and make objective decisions when determining priorities and allocating funds and other resources for system development activities.

One of many benefits of strategic data planning is that it increases the value and accessibility of the University's data resources. Over time, this should reduce the number of systems and the amount of data needed to run the University. Strategic data planning will identify administrative systems that can share the same data. In the past, many administrative systems were developed to automate the processes within a central administrative unit (sometimes referred to in the industry as "islands of automation"), and the data wasn't easily accessible to those outside the central unit. As a result, many departments had to develop local systems to supplement the central one, which led to redundant systems and redundant data entry across the University.

The implementation of relational database technology is helping the University overcome this problem. Strategic data planning, when coupled with the ability to access distributed data through relational technology, will make it easier for users to access and manipulate administrative data to serve their particular needs, which should lead to streamlined business processes and procedures. Strategic data planning also contributes to institution-wide communication and education about the data and functions of the University.

Responsibility for coordinating and developing the strategic data plan is assigned to the Coordinator of Administrative System Planning. This position was established in fall 1991 as a joint appointment between the Controller's office and Data Administration. The position reports both to the Director of Data Administration, and to the Controller and Director of Financial Operations. At the direction of the Vice President and Chief Financial Officer, the Controller and Director of Financial Operations has responsibility to oversee planning for administrative systems development for Business and Finance and to coordinate those plans with other vice-presidential areas.

Methodology

During 1992, staff from many groups and departments on the administrative and academic sides of the University attended meetings where they learned about the University's intention to develop an institution-wide strategic data plan. Staff had a chance to ask questions and to provide their input to the planning process. Presentations at these meetings outlined the steps involved in strategic data planning, which include:

1. Planning the Plan

This step took most of one year to accomplish (about .5 FTE) and some activities still need to be addressed. The planning step includes setting the scope of the initial effort, communicating with those included in the scope to promote the effort and to identify participants, training for the Coordinator of Administrative Systems Planning and support staff, designing a methodology, purchasing a Computer Aided Software Engineering (CASE) tool to support the methodology, and preparing a schedule of the order in which functions within the scope of the effort will be addressed.

With input from the Vice President and Chief Financial Officer and others, the initial scope of strategic data planning was set in this step to include the administrative functions that fall primarily within Business and Finance and Academic Affairs. Other areas of the University will be added in later phases. Units need to define each function for which they have primary responsibility; one person from each unit will lead the effort to define the functions that are the primary responsibility of the unit. Other participants will include staff and faculty administrators who have some role and responsibility in the function being defined.

Another part of the planning phase is developing a methodology (that is, customized procedures and techniques for implementing the plan). The methodology developed at the University of Michigan is based on the Information Strategy Planning phase of the Information Engineering methodology popularized by James Martin. Because the strategic data planning effort requires working with massive amounts of information that are too unwieldy to handle manually, a CASE tool is being used to help collect information and analyze the models that are to be defined. The Planning Tool from KnowledgeWare, Inc. was selected to support the strategic data planning effort.

2. Defining Goals and Problems

If we don't change our direction, we might end up where we are headed - Chinese proverb

Administrative systems must be designed to meet the long-term goals of the University as well as resolve existing, ongoing problems. In addition to just being a good idea in general, a shared set of goals and problems will help provide direction to the strategic planning effort. Initially, strategic planners must work with representatives to identify and forecast the goals and problems that will have a University-wide impact during the next five years. A variety of methods will be used to collect goals and problems; Total Quality Management, currently underway at the University, is having a positive impact on this step. The results will provide the basis for the next steps--defining the function model and the data model.

3. Defining the Function Model

A function is a group of processes that supports one aspect of operating the University. Procuring goods and services, managing human resources, and admitting students are examples of functions. While a function is ongoing and continuous, processes are specific tasks that have a definable beginning and end. As shown in the illustration, a function model for the procurement of goods and services could include processes such as creating purchase requisitions, maintaining supplier information, creating purchase orders, recording invoices, and paying invoices.

A function model will be defined by working with a group of representatives in facilitated meetings. The function model helps the University clarify and communicate what it does independently of how it is organized. It also provides a tool to define the data needs of the University.

4. Defining the Data Model

Data modeling at this level of planning focuses on defining the major entities and relationships that support the functions and processes mentioned in the previous step. This type of data model establishes a framework for standardizing, integrating, and planning administrative information systems (see illustration). A data model will be defined by working with a group of representatives (usually the same group used to define the function model) in facilitated meetings.

Staff in the Data Administration group will work with users to compare and consolidate these data models across functional boundaries to form an institution-wide data model, which will, as part of the data architecture, provide the basis for the data planning efforts of the Data Administration group.

5. Integrating the Function and Data Models: Data Source and Use Analysis

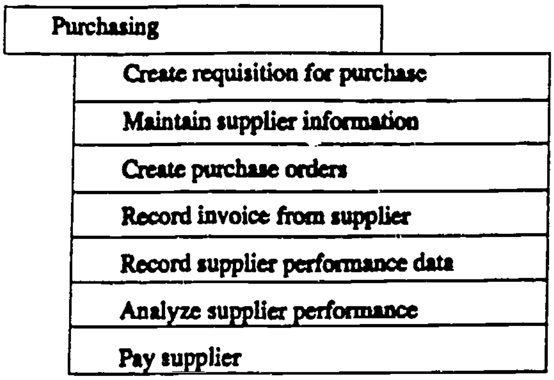
To integrate the function model and data models, strategic planners must determine the relationships between the functions and the data by identifying the data entities that each function creates, maintains, or uses (see illustration). The integrated model can then be used to identify strategic projects and prioritize them as part of an overall administrative Information Systems Plan.

There are a variety of analytical techniques that will be used to identify and prioritize projects. Affinity analysis is one example of a technique that will be used to identify strategic projects. Affinity is defined as a likeness based on a relationship or causal connection. In this step, affinity analysis measures the affinity between entities and processes based on the source and use information. This allows the planner to cluster processes and data together into a natural business areas (or projects). Another technique, called the Northwest rule provides the planner with the proper implementation sequence for the projects. Clustered processes that create information should be implemented before processes that update or use information. If information is not available in electronic form, it makes little sense to automate a process or set of processes to use the information.

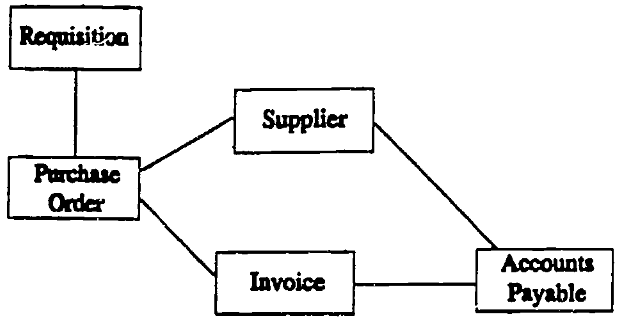
6. Architecture

In addition to the steps outlined previously, a technology architecture must be defined to indicate the hardware, software, and networking environment necessary to support the models. Given the constant evolution of technology, this step is difficult to accomplish, and any decisions can be rendered inaccurate or obsolete by new developments. At the University, an effort to define this environment for ad hoc reporting was just completed. Most of our current mainframe applications reside in IMS systems. The plan for enhancing the ad hoc reporting environment calls for this information to be moved into an Oracle RDBMS environment running on IBM RS-6000 servers. A separate effort to define a new application architecture for operational systems is currently underway.

Simplified Examples of a Function Model, a Data Model, and an Integrated Model



Function model in which Purchasing is the function and the subordinate items are processes.



Data model indicating relationships between entities. Attributes are not shown at the Strategic Data Planning level. For Requisition, attributes might include item number, description, quantity, unit price, total, and account number.

	Data				
Functions	Accounts Payable	Invoice	Requisition	Purchase Order	Supplier
Create requisition for purchase			C		
Maintain supplier information	R	R		R	CRUD
Create purchase orders			R	C	R
Record invoice from supplier	C	R		R	R
Record supplier performance data	R	R			CU
Analyze supplier performance	R	R		R	R
Pay supplier	RU	RU			R

Note: C = create, R = read, U = update, D = delete

Integrated model reflecting the integration of the function and data models.

Note: These examples are not organization-specific; they do not necessarily represent the purchasing function at the University of Michigan.

7. Preparing an Information Systems Plan

Staff in University units and the Data Administration group will analyze the functions and data entities and identify the units that are responsible for them or use them in support of their mission. Also, UIS staff and users will inventory and evaluate current systems--including systems developed and housed on the administrative computing mainframe and local systems developed by individual units--to determine how well they support the defined models. The Information Systems Plan will be based on the results of the analysis of this information and the integrated model. The Information Systems Plan will provide objective planning information to those making funding decisions and prioritizing systems development efforts. More detailed systems project work can take place based on the models once the appropriate priority and funding decisions are made.

The intent is to update the Information Systems Plan annually and incorporate it as an integral part of the University's strategic planning process. A plan that is not updated periodically to reflect changes in goals and objectives will quickly lose its significance.

Selling the Approach to Management

While leadership from Data Administration is critical to the success of strategic data planning, there must be a champion at the executive level for it to be successful. With competing priorities and demands for time, strategic planning of any sort can lose its focus and momentum without constant support. Since the Vice President and Chief Financial Officer wanted to see a plan for administrative systems and is interested in making information more available, selling strategic data planning was fairly straight-forward in the Business and Finance division. It was much more difficult in the Academic Affairs arena where leadership changes were taking place at the same time we were trying to get this division on board. A number of months were lost because of the leadership changes. In retrospect, we should have moved forward on the functions in the Business and Finance area that have minimal direct impact on Academic Affairs functions without waiting for the Academic Affairs endorsement. Valuable momentum was lost; changes in management and delays are among the major pitfalls of a strategic data planning process.

Selling the approach to lower level management is equally important. These are the individuals primarily responsible for the functions we are trying to define. By definition, staff at these levels of management are inherently more narrowly focused than people at the executive level. Some find it difficult to achieve and maintain a broad vision of the institution from a systems and data perspective, and therefore, they have trouble understanding the need for and benefits of strategic data planning. Hence the need for support from the executive level. The executive officer can resolve issues, commit resources, and set priorities when necessary. Some staff will understand the need and benefits but may identify issues that must be addressed in order for data administration and strategic data planning to be successful. Documenting these issues and getting executive management to address them contributes to the creditability of the effort. In summary, ongoing communication is a key element in selling the approach to the institution.

Issues

During the presentations to the units within the initial scope of the strategic data planning effort, several issues were identified.

- Concerns about the impact on budgets and project funding

Some participants were worried about budget cuts and being asked to do more with the same or less funds. Some participants suggested that funding for developing strategic and tactical projects should be addressed separately from maintaining and operating current systems. The budget situation at the University of Michigan, while not unique, is a sensitive and very real issue.

Efforts are underway to review how priorities are set and funding is allocated for administrative information systems development, maintenance, operation, and access. It is expected that these efforts will address most budget concerns to some degree. The approach must strike a balance between strategic, tactical, and operational decision-making, control, and funding by departments and central units. The Strategic Data Planning effort is intentionally separate from an individual unit's budget process and is meant to be a tool for those individuals and groups making decisions about administrative information systems.

- Concerns about the impact on current projects, unit-specific enhancements, or mandated changes to operational systems

Mandated changes will continue to be a reality and must be addressed on a timely basis. Until the first Information Systems Plan is complete, it would be difficult to understand the impact on current development projects. Extensive, ongoing development that does not adhere to an overall architecture can negatively impact a strategic data planning effort. In one recent case, we were able to convince people who were working on several related projects to reconcile their data models by participating in the creation of a high-level data modeling effort. Another way to address this is to encourage communication and cooperation among projects. Units should ask themselves what other units might be affected by any proposed system changes and include those units in the project planning process. The Coordinator of Administrative Systems Planning is working with others to facilitate this process.

- Questions about the amount of effort required by units

Many units were concerned about the amount of time they would be required to invest in this effort. Units will need to be involved in every step of the Strategic Data Planning methodology; <u>this is ultimately a business plan rather than a technology plan</u>. One of the major pitfalls of a strategic data planning effort is not involving the right individuals. If someone is not involved, that individual may not be supportive of the results.

The amount of time required will depend on the size and complexity of the functional area being defined. A six to eight week duration for each function is considered reasonable. In addition, units and technical staff will be asked to inventory the current systems. A tentative schedule, based on functional areas and identifying potential participants, will be published for review. During the planning stage for each functional area, a project plan providing detailed estimates of the necessary resources will be prepared.

- Need for total involvement and cooperation from all units within the scope of the effort

Most units believed that this planning effort would be successful only if all of the units within the scope of the effort participate in the process. Some units believed that the models must be used by management to make decisions about future administrative information systems development projects for Strategic Data Planning to be considered successful.

Participants with an opinion felt strongly that Academic Affairs should be included in determining the initial scope of the effort, as the Vice President and Chief Financial Officer originally suggested. Many Business and Finance functions are tightly linked with Academic Affairs. As was mentioned earlier, efforts to include Academic Affairs units took significantly longer than efforts to include Business and Finance. Other participants from outside of Academic Affairs and Business and Finance are identified and invited to participate on an as-needed basis.

The following recommendations were documented and communicated to management in response to the previously listed issues:

- Address project funding and budget issues.
- In the interim prior to the completion of the Strategic Data Planning effort, focus on communication, coordination, and "customers" with all current administrative systems projects.
- Produce a schedule, identifying sequence and participants, for the Strategic Data Planning effort.
- Ensure commitment from all parties within the initial scope of the Strategic Data Planning effort.

- Other Issues

There are three other "pitfalls" to be aware of that didn't necessarily come up in the presentations to staff. Many times, strategic data planning identifies a need to reorganize. The integrated function and data models produce "natural business areas" that may be different that the current organizational structure. While this doesn't mean an institution must reorganize, it does make management aware of the possibility.

"The art of progress is to preserve order amid change and to preserve change amid order." (Alfred North Whitehead, philosopher and mathematician)

The second pitfall is migration. Migration is a critical implementation component of strategic data planning and it is essential that the methodology and resulting Information Systems Plan produce a realistic migration plan.

The last pitfall is a fear or lack of understanding of a data-driven methodology. Strategic data planning is a new approach to many people. Some find it difficult to make the transition from more traditional planning and development methodologies. Continuing education and communication directed at this issue is important to the overall success of strategic data planning.

Current Status and Experiences

As of this writing, strategic data planning is underway in two areas and plans are being made for other areas. One area is the function "procure goods and services" and is being accomplished as part of a Total Quality Management Quality Improvement Team's (QIT) efforts. The QIT had already defined its goals and problems. The Coordinator of Administrative Systems Planning came in at this point, at the group's request, to create a strategic data plan based on those goals and problems. This effort is not yet complete. Another area is student-related information. Several student-related projects were in progress, and a discussion on strategic data planning disclosed a need to define a high-level data model to guide the individual projects. Plans are also being made to do strategic data planning for the personnel and finance areas. After discussions with executive management, a schedule will be prepared for the rest of the functions within Business and Finance and Academic Affairs.

Those involved in strategic data planning will quickly learn the value of flexibility. While having a methodology is important, it is equally important to know how to get results using many different techniques and in different sequences. Each group's situation is unique. It is the responsibility of the strategic data planning coordinator to recognize the needs of the group and adjust accordingly. Obviously one will get better at this with experience and training. An approach to this problem is to contract with a consultant with experience in this type of planning. Much of the research indicates that you should not attempt strategic data planning the first time without a consultant. (Of course, the consultants write most of the articles and hold the seminars where you obtain this information.) We decided to move forward on our own for political and monetary reasons. We did, however, pilot the methodology on a low-risk , low-visibility project prior to trying it for "real."

Some consultants indicate that it takes up to five iterations to get a solid plan in place. Given the fact that we expect to update the plan on an annual basis, we expect it to take up to five years to have a complete, detailed strategic data plan. We do expect interim results given that we intend to make decisions based on the results of this plan in the budget process for 1994-95. A lack of interim results is another common pitfall that we want to avoid.

SUMMARY

"The more people realize that strategic planning can be quite real in its consequence, the more seriously they will take it." (Bryson, 1988)

Rapid technology changes are creating many challenges for information systems organizations and, at the same time, providing new opportunities to information systems users. The increased need for access to institutional data is driving the need to manage the institution's data resources more than ever. The University of Michigan is meeting this challenge by establishing a Data Administration to ensure the accuracy, integrity, reliability and accessibility of the data resource.

As the University's investment in information technology continues to climb, it stands to reason that the University should incorporate information technology in its decision-making equation and focus its investment on those projects that contribute directly to the goals and objectives of the University. Data Administration and the strategic data planning effort are key factors in developing a plan to meet these goals and objectives.

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INFORMATION TECHNOLOGY: The Revolution Continues

INFORMATION RESOURCES MANAGEMENT

W1-4

Moving Toward a Campus-Wide Information System: Leveraging the Existing Investment in Information Technology

Alan Hargrave
Baylor University

38th Annual
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Moving Toward a Campus-Wide Information System:
Leveraging the Existing Investment in Information Technology

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Much is said these days about Total Quality Management. The basic theme behind TQM is that the customer demands a quality product at the lowest possible cost. More than just a "the customer is always right" approach, TQM focuses on producing a quality product from the start rather than just correcting mistakes. It is a management philosophy that recognizes the importance of the customer's right to choose another producer if they are not pleased. The fact that there are many producers of a particular product increases the customer's ability to choose. The result is that products are driven by the consumers rather than by the producers.

Colleges and universities traditionally represent a producer driven economy. Our customers, the students, are held at our mercy with regard to the quality of the product, their education. However, with increased emphasis on accountability, we are moving toward a consumer driven economy where the students increasingly demand quality in all areas of their academic experience. This goes beyond the classroom to include all areas of their interaction with the university. How simple (or difficult) it is to register for classes or to use the library are just as important to the perception of quality as is the instructional experience itself. This is where a campus-wide information system (CWIS) can play an important role in improving the quality of the product we produce.

Campus-Wide Information Systems

Just what is a CWIS? Ideally it is all things to all people. Anytime one needs information ranging from today's news or weather to the class list for next semester, the CWIS should be the first place consulted. Technology has provided an exceptional opportunity to deliver information directly to the customer. The problem with many technology solutions today is that much of the information the students desire is not directly available to them. For example, it is not unreasonable for a student to want to view a current copy of his/her transcript. However, it is still the exception rather than the rule that this is directly available in any form without a trip to the academic records office. This is true even though the transcript is probably maintained in machine readable form on a computer.

For a CWIS to solve the problems of information delivery to the university community, it must meet three important criteria. The first of these is accessibility. The ideal CWIS can be reached anytime from any location. In practice, the CWIS should be available 24 hours a day from any kind of computer workstation, both on and off campus. Other technologies such as the telephone should serve as access points when the type of information makes it reasonable. Even though it is impossible to implement this ideal

level of accessibility, any CWIS that does not aspire to this goal may be limited in its success.

The second criterion for a successful CWIS is usability. The system must be easy to use and it must be easy to find the desired information. These are not necessarily the same. Elaborate menus may make a system easy to use but if a person cannot find the desired information they are of little value. Training in the use of a CWIS should be avoided if at all possible. In other words, it should not require a high level of expertise to successfully use a good CWIS.

Finally, and probably most importantly, a good CWIS must provide the information that people want to see. This information can be divided into two categories: general interest and specialized. General interest information such as today's weather, the daily calendar of events and the menu at the student cafeteria is what will attract people to the system and make them regular users. Specialized information is that which has a very limited audience either by the nature of the information or needed restrictions on its access. For example, a student's transcript is certainly specialized information in that it should only be accessible by the student or appropriate university staff.

Many current CWIS implementations do an excellent job of providing general interest information but do not go on to provide specialized information. The transcript example cited above would not even be considered as a part of the CWIS. While there are good reasons not to burden a general interest system with specialized information, the former can provide simple links to the latter. For example, one feature of the CWIS might be to call the transcript program. The transcript program need not be part of the CWIS per se but could actually be a totally different system with its own security, etc. A major advantage to such an approach is that the CWIS becomes the single point of access for a wide variety of information.

Providing a general interest CWIS is relatively easy since several public domain implementations are readily available. One simply installs software on a server and provides document files that contain the information. Access software is then installed on client workstations so that the information can be viewed. Depending on the particular implementation chosen, software is available for a wide variety of both server and client platforms.

One difficulty lies in providing the specialized information that can be a part of, or accessible from, a truly global CWIS. Much of this information already exists in computerized form on many campuses. The problem is that most of it is "locked up" in production systems and inaccessible to the average user (student or faculty). How then do we provide an information rich environment within the context of an existing investment in information technology?

The Existing Investment in Information Technology

The volume of information that must be processed to run a university requires that automated systems be employed. Most campuses have invested heavily in systems to handle areas such as registration and enrollment, student billing and financial management. Whether these systems were locally assembled or purchased, one thing that most have in common is that they were developed to automate existing tasks. While these

automated systems may help process large amounts of information, they do not always lead to a higher quality product for the student.

In order to improve the quality of our information systems and move toward a CWIS, we must first look at the types of people who use the information they contain. There are two basic types of information users: 1) the production user and 2) the casual user. The production user is represented by the university staff member whose job involves a high level of interaction with the information system and requires a high level of efficiency out of it. In contrast, the casual user may not need the information on a regular basis and tends to be less concerned with efficiency in the same sense as the production user. This person's concern is "can I get the information I want and how easy is it to obtain?"

The problem with many current information systems is that they were written with the production user in mind. This is not to say that they were poorly designed or that they have not benefited the campus. Certain tasks can and should be automated. However, by designing for the production user, the casual user is often not considered. This means that the casual user (for example a student wishing to confirm their address) cannot directly benefit from the system. Hence this person, our customer, does not perceive any benefit from the system.

How then do we provide information to the casual user? Few campuses can afford to completely re-write (or re-purchase) all of their information systems just to satisfy this need. Even if purchasing a new system is an option, most commercially available systems are only now beginning to recognize the need and begin development in that direction. Therefore, we must find ways to provide information directly to our students in a way that takes advantage of existing systems. In other words, we must leverage our current investment to maximize its benefit. At the same time, new systems must be designed with the person who cares most about the information (the student) in mind.

Many campuses deal with providing information to an audience outside that of the production user by providing alternative access methodologies. For example, user-friendly front-ends are often developed so that ad-hoc queries can be performed against production data. In the past, this was often a difficult approach. However, now there are a variety of tools available that make this a very reasonable approach. It is this approach that has been taken by Baylor and is described below.

The Baylor Information System

It was stated earlier that a CWIS is ideally all things to all people. Designing such a system is in reality an impossible task. The fact that this task seems so daunting has probably kept many from even attempting it. However, a much more reasonable approach is to select individual systems and design an interface for the casual user one system at a time. These smaller systems can then be integrated together under some kind of umbrella system and before you know it you have a CWIS. The Baylor Information System (BIS) is such an umbrella system that is composed of many elements.

The goal of the BIS is to provide first-hand (i.e., direct) access to desired information in a manner that is easy for the casual user of the information. The latter part of this goal is particularly important in that most of the development effort is spent there.

Much of the information provided under the BIS is available first-hand from the production systems used to manage it. However, access through these systems is geared toward the production user and this often presents a significant hurdle for the casual user. Also, the production systems often lack the kind of security needed for general access. For example, the transcript module of our student system does not have the ability to restrict who has access to which student's transcript. The only control is over who has access to the module as a whole. Properly designed front-ends can overcome these limitations in the production application.

Before describing the BIS, a description of the environment at Baylor is in order. Baylor University is a medium-sized liberal arts institution with an enrollment of about 12,000 students served by 1,500 faculty and staff. The desktop environment consists of over 1,200 Macintosh and 400 PC (or clone) workstations. Most of these are connected to the campus AppleTalk/Ethernet network. This network provides access to file and print services as well as access to various host computers and the Internet. Production systems in use include the Student Information System (SIS) from Information Associates, a locally developed Human Resources System (HRS), the College and University Financial System (CUFS) from AMS and the multiLIS library system from Sobeco. The SIS and CUFS systems are run on an IBM 4381, HRS is run on a Honeywell DPS 8/49 and multiLIS is run on a VAXcluster. Leveraging these production systems into BIS involved several principles which will be described below along with examples of their application.

Principle One: Carefully Select the Target Workstation

There are two common approaches taken here. One alternative is to select a lowest common denominator approach. This approach is often necessary when a wide variety of client workstations exists on campus. It often means designing non-graphic, character-based systems that sometimes use the client workstation as a simple terminal. This can limit the ease of use for the client as well as limit the information display capabilities. The second alternative is to select a particular workstation and concentrate efforts in that direction. In Baylor's case, the large number of Macintoshes on campus led us to select it as our primary workstation. Also, the "point and click" style graphical nature of the Macintosh lends itself well to the casual user for which the BIS is designed. Even with this choice, there was still an element of the lowest common denominator approach in that most of the Macintoshes on campus are low end models (Plus, SE or Classic) for which performance is a concern. Limiting our efforts to one client allowed us to bring a much higher level of functionality to that platform than would have been possible with multiple platforms.

Principle Two: Adopt a Tools Based Approach

Take advantage of existing tools so that development does not have to start from scratch. In particular, a wide variety of what are called "information harvesting" tools is readily available. Some of these tools serve as the foundation for application development while others can be used directly. For example, the BIS makes extensive use of Data Access Language (DAL) to access data residing in Rdb databases on the VAXcluster. DAL is a standard protocol for accessing data in relational databases and it forms the foundation for some of our programmed applications. On the other hand, DAL extensions built into programs such as Microsoft Excel allow them to be used directly to access host

based data. We are now in the process of developing a new application that takes advantage of this functionality.

A corollary to this principle is to try every tool that you can get your hands on. The BIS relies on information from a variety of sources and no single tool works well with all of these sources. Also, different tools have different strengths when it comes to issues such as security and presentation capabilities. While it is important to try various tools, it is not advisable to use too diverse a group of them in the actual CWIS. Maintenance and support of the applications developed then becomes a problem. Pick the tools that work well with your existing production systems and stick with them.

Principle Three: Deliver Prototypes

Many components of the BIS were developed as prototypes that were delivered to key individuals for testing and feedback. The importance of this principle cannot be overstated. Prototyping generally avoids a long system design phase in favor of rapidly assembling a working model for an application. The prototype can then be placed into the hands of potential users and the design refined as they provide feedback as to whether or not the application meets their needs and is easy to use. For example, the front end to the financial system was placed into the hands of a few department chairs who routinely had need of the information provided. They provided valuable insight into what was really needed out of this component of the BIS.

Principle Four: Don't Just Emulate the Production System

It usually turns out that the casual user is only interested in key functions so enable them without wasting time trying deliver an interface to the whole system. Additional functionality may be added later if it is really needed. Also, take advantage of the opportunity to add value to the information in the production system. For example, there is a particular piece of information in our production financial system that is stored as a two-letter code. The BIS front-end to that system takes care of translating that code into a meaningful phrase for the user.

Principle Five: Be Willing to Create Derivative Information

Some production systems simply do not provide the needed information by themselves or adequate information harvesting tools do not exist. In these cases, one must be willing to create derivative products that bring together the necessary information in a manner that is accessible. Derivative information sources violate conventional wisdom that there should be a single source of a particular piece of information. However, with proper procedures for automatically updating the derivative information, most problems can be overcome. The student advisement (transcript) module of the BIS is a good example of a derivative information source. The transcript module of the production student information system does not store transcripts but creates them on demand by collecting the appropriate information on the requested student. Unfortunately, this can be a rather slow process. To overcome this, transcripts are created in a batch mode and loaded into an Rdb database The student advisement system then retrieves complete transcripts from this database in a much more timely manner.

Another example of a derivative information system included in the BIS is our

directory application. The original source for directory information on students is the student information system while directory information for employees is stored in the human resource system. Information from each of these sources is updated daily into one derivative database against which the directory application in the BIS runs.

Principle Six: Use Existing Systems Where Possible

Some "production" systems actually are very usable as they are. In the case of the BIS, the library card catalog is available directly from the production system. This menu driven application is simply called from the BIS main menu.

Principle Seven: Include a Healthy Dose of General Interest Information

The emphasis of this paper is toward making use of existing information systems as a part of a CWIS. However, most of this information is specialized and only specific pieces are of interest to any one individual. By including generous amounts of general information in the total CWIS, its utility is increased and people establish the habit of consulting it. In Baylor's case, this general interest information is supplied through an implementation of TechInfo from MIT. (Our implementation is known as BearInfo after the Baylor mascot.) Information contained in BearInfo includes the university calendar of events, the microcomputer store price list and the class list for the current and the next semester. The class list includes enrollment totals so that students can easily check for open and closed classes during our pre-registration process.

BIS Summary

How does the Baylor Information System stand up against the three criteria stated earlier for a campus-wide information system? Accessibility to the BIS is not universal. In its present implementation, full BIS functionality is available only from a Macintosh workstation connected locally to the campus network. However, since the majority of the workstations on campus are Macintoshes, this has not been a severe limitation. In usability, much effort has gone into providing interfaces that are easy to use and focused enough in their scope that information is easy to find. In terms of the information that people want to see, we have provided interfaces to most of the production systems so that more information than ever before is available from an individual's desk top.

This is not to say that there are not limitations in the BIS. Student access to some key modules is still not provided since security and other issues are yet to be fully resolved. Some modules are only available during certain hours because of the schedules for the production systems on which they depend. Finally, there is still much information that is not available through a friendly interface under the BIS.

Closing Thoughts

Providing a good CWIS requires a vision for an information rich environment that empowers students. While this vision is commonly shared with regard to academic information, administrative information is often excluded. While privacy considerations require that certain information be regulated, campuses must move from being information controllers to information providers. A basic model is that if the information is about me, it should be easily accessible by me. Some of this information, such as my

address, should even be modifiable by me. Granted, such an openness can result in abuses. However, the alternative is a tightly controlled system that is perceived as unresponsive to the students who expect it to serve them. Unresponsive systems will be labeled as poor quality systems and the students will seek alternatives, possibly by taking their "business" elsewhere.

Security of information that should be private between the university and the student will always be an issue and justifiably so. However, we must address this issue rather than letting it be an excuse not to provide direct access to information. The banking industry provides a good model for this in automated teller machines. Certainly the security of an individual's money is a very important issue. However, if banks had spent all of their time lamenting potential misuse of ATM cards, we would still not have automated tellers. Instead, a means of providing security was implemented through personal identification codes and personal banking has been radically changed.

A common form of information access is through what is referred to as client-server computing. While we often think of this in terms of the technology involved, more attention needs to be placed on the relationship between the university (the server) and the student (the client). The CWIS can be an important mechanism to foster this relationship and increase the student's perception of quality. Also, as more information is placed directly into the hands of students, there may be traditional production tasks that are no longer necessary. This frees personnel to engage in actual service to the students, further raising the perception of quality.

There is obviously a very real cost to providing a CWIS. However, the question to ask is not "what will it cost to do it?" but "what will it cost not to do it?" As additional emphasis is placed on the quality of the total educational experience, those universities without an attention to the customer will be unable to compete. The cost of not having an effective CWIS will be measured in decreased customer satisfaction that will lead to an inability to attract and retain students.

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INFORMATION TECHNOLOGY: The Revolution Continues

EMERGING TECHNOLOGIES

M2-5

Open Systems: 'An Overview for End-User Managers'

D. D. Badger
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OPEN SYSTEMS
'AN OVERVIEW FOR END-USER MANAGERS'

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OPEN SYSTEMS
'AN OVERVIEW FOR END-USER MANAGERS'

PREAMBLE--ACRONYMS AND 'BUZZWORDS':

Many 'computer people' can't seem to avoid speaking to end-users in cryptic acronyms and industry 'buzzwords' and this unfortunate habit is often resented by users of technology and systems. The result of too much technical terminology is invariably a **'communications gap'** between systems people and their clients--the systems users.

In this paper, it is unavoidable to introduce many computer acronyms, but I will try to keep the bulk of the discussion in simple English. This paper and the conference presentation are addressed to end-user managers of computer systems. This is not a discussion or debate of the strengths and weaknesses of Unix versus Windows!

Hundreds of new abbreviated 'words' get created each year and become part of the technology vocabulary (Exhibit 1). But just as 'perestroika' and 'glastnost' were added to our everyday English vocabulary, so do many terms from the technology field (eg. hacker, nanosecond, etc.).

To help advance your technology vocabulary, I have included a glossary (Appendix II) of most of the terms and acronyms mentioned in this paper. You can use this to impress both your computer-literate and illiterate friends, and hopefully help bridge the communications gap with your systems people.

OPEN SYSTEMS DEFINED:

Open Systems is the opposite of 'proprietary' or 'closed'. The leading proprietary environments for the past ten years have been IBM's MVS and Digital's VMS operating systems. Application software solutions are generally not portable between proprietary environments.

Open Systems are computing environments where the hardware and software of different vendors are interchangeable; ie. they adhere to recognized standards for information exchange, networking and portability.

DMR Group's Vice-President of Technology Don Tapscott defines open systems as "software environments based on standards which are vendor-independent and commonly available".

Montreal-based DMR Group is one of North America's leading systems consultants and is active in establishing uniform open systems standards as the primary consultant to the Open Systems Foundation (OSF).

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CAPABILITIES:

The most widely desired capabilities of Open Systems are **interoperability, portability, scalability and availability.** These capabilities require vendor-independent computing components (ie. programming languages, database management software, operating systems, user interfaces, network management etc.) all working together to deliver cost-effective application solutions to end-users.

Interoperability means the ability to network systems from multiple vendors. One example would be the sharing of data residing in one database among several applications running on different hardware platforms. Another example would be a single application obtaining data interactively from multiple distributed databases.

Portability means that application software is readily movable from one computer platform/environment to another. An example would be the capability of moving a General Ledger package from an IBM computer to a Digital or H-P computer.

Scalability is the ability to migrate an application among a range of platform sizes, from PC's up to large mainframe-type hardware systems.

Availability simply means that the application solutions are both deliverable and numerous in the marketplace, and not captive or dependent upon vendor-specific products.

COMPONENTS:

To achieve the desired Open Systems capabilities, there is a need to standardize the major components of the computing environment. These components are:

* **the user interface**
* **the database interface**
* **operating system interface**
* **the network interface**

Exhibit 2 graphically shows the layers or components of the computing environment. Standard interfaces make it possible for different computer systems to run application software interchangeably (ie. portability) and achieve the networking benefits referred to as interoperability.

A standard user interface enables the user to interact with the computer system in the same way regardless of the application or type of computer being utilized. The user interface, especially a Graphical User Interface or 'GUI', seems to achieve a quick learning curve which is largely portable from one application to another.

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THE STANDARDS MORASS:

The key issue in any discussion of Open Systems can be summed up in one word, standards. Although substantial progress toward achieving the open systems ideal has been made, the efforts are hindered by the reality of multiple 'standards' in competition for market acceptance and industry recognition.

There are two types of computing standards; **"de-facto"** and **"industry"**. Unofficial specifications that are widely used in the marketplace can become de-facto standards, and specifications that are agreed upon by neutral, public organizations are industry standards.

For example, the Unix operating system is widely viewed as being the de-facto standard open operating system. There are, however, various versions of Unix which have evolved from the earliest version produced in AT&T's Bell Labs over twenty years ago. The two most popular versions of Unix today are based upon AT&T's (System V) and Berkeley Software (BSD). These are de-facto standards.

Several standard-setting organizations (IEEE, ANSI, OSF) are supporting the development of a true industry standard operating system based on the two leading Unix 'flavours'. One project receiving considerable attention and support has been given the acronym POSIX, standing for Portable Operating System Interface. Posix will be the set of interface 'services' in common with different vendor-specific Unix flavours in the marketplace. OSF is also supporting the definition of a standard Unix-based operating system called OSF/1.

There are both de-facto and industry standard specifications for the user interface element as well. The most widely recognized are Microsoft's Windows, IBM's Presentation Manager, X Windows, and OSF/Motif.

Exhibit 3 illustrates the evolution of standards as a continuous cycle. Standard-setting organizations and vendors are shown on the inside influencing the definition, specification and implementation processes.

The development of formal standards takes time, and inevitably user or market needs race ahead of the process, creating gaps between defined standards and market needs. As vendors fill the gaps with enhancements or extensions, the standard both fragments and evolves to its next iteration.

The fact that standards are not static, but are continuously evolving means that the Open Systems objective is a moving target and an ongoing challenge for decision-makers.

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OPEN SYSTEMS BUSINESS BENEFITS:

There are both tangible and intangible business benefits associated with Open Systems. Some of the obvious advantages include:

1. Cheaper Hardware:

   Open Systems should deliver hardware cost savings as computing power becomes a generic commodity, ending vendor dependence (ie. multiple suppliers/competitors of essentially the same product).

2. Cheaper Software:

   Open Systems means software can be developed across a much wider spectrum of computing platforms. The enlarged market should increase the supply and volume of software sales, resulting in lower prices for packages. An Open strategy should result in less specialized (expensive) expertise, the utilization of more common technical tools, and therefore lower development costs.

3. Better Solutions:

   The end of single-vendor proprietary environments in the corporate setting enables the development of enterprise-wide networks and the selection of 'best of breed' components from multiple vendors.

4. Responsiveness:

   Data/information becomes more accessible and sharable across previously isolated applications. This is the business goal of interoperability (ie. improved retrieval time and improved integrity of information).

5. Flexibility:

   Open Systems have the advantage of operating from desktop platforms to the largest mainframes (ie. scalability). This flexibility allows applications to change over time to the evolving requirements of end-users and the entire corporation.

6. Investment Protection:

   Current investments in 'legacy' systems can be protected and extended by the ability to build upon and incorporate open technologies.

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CURRENT TRENDS:

The most widely-touted solutions riding the Open Systems wave at the moment are Unix, Client-Server Architecture, Windows, SQL and Downsizing.

Unix has already been discussed as the operating system which is most 'open' to a multiple-vendor environment. Unix has rapidly become adequate for most commercial applications, addressing concerns of many with IBM mainframe backgrounds about system management and security.

In addition, most independent software developers have aggressively jumped onto the Open Systems/Unix band-wagon. This is going to mean application software that historically has been targeted and priced for the mainframe market will be much cheaper and available on a variety of Unix platforms.

Client-Server architecture is a relatively new design concept (not a product) which moves substantial application functionality to the end-user's desktop PC. The Client-Server approach takes advantage of cheap hardware which in many cases already exists on the desk. Only the database server hardware must be acquired and this will usually be only a fraction of the price of a traditional mainframe or minicomputer.

Microsoft's MS/Windows has been an amazing market success story with over 10 million copies of the product sold to PC users. Software developers are now ready to provide applications to run under Windows and tools to develop Windows-based systems. The Windows/GUI environment is viewed by many as a prerequisite part of systems built using a client'server architecture.

Probably the number one Open Systems capability users are looking for is interoperability; accessing data across multiple platforms/applications. To achieve this capability requires a standard method of interacting between applications and databases and the open solution is the SQL standard. SQL (Structured Query Language) provides a set of application programming interfaces or 'calls'. Relational Database software systems which support the SQL interface allow applications to update and query data which is physically distributed across a network.

On top of these technical trends is the movement towards downsizing, rightsizing, and re-engineering. Organizations that are embracing Open Systems strategies are hoping for substantial cost savings as mainframe computer centres are transformed into network centres and a handful of $20,000 processors/servers replace $2 million mainframes. Some organizations are striving to completely reinvent or re-engineer their information and support systems, and are adopting an open strategy as a starting point.

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SUMMARY:

A recent report on the open systems market from N.Y. based consultants Frost & Sullivan International predicts that users will place more emphasis on certification of products and conformance testing to ensure adherence to industry standards. They predict that sales of open systems in the U.S. will rise from $23 billion in 1991 to $81 billion in 1996.

DMR's 1991 study of Open Systems Status in Canada describes both an old and new model of computing. The old being a proprietary, host-based, rigid, top-down, non-integrated, vendor controlled architecture unable to meet global, volatile, competitive business needs.

The new 'Open' model includes: integration through network centered architectures, multi-platform applications, workstations with graphical user interfaces, cooperative processing and client-server applications, and external links to clients and suppliers.

DMR's study also indicated that the greatest barrier to the adoption of open systems was the lack of awareness among decision-makers of the advantages (and disadvantages) of open systems.

Most large organizations have huge investments in functioning 'legacy' systems that they want to integrate with newer technologies. Adopting an open systems strategy doesn't have to mean throwing out existing investments in software and training.

To survive in the marketplace, technology vendors are going to embrace 'openness' and provide 'hooks' to proprietary applications. If you have chosen your vendor alliances wisely or luckily, your current applications can quite possibly migrate to open compliance. Corporate networking will become the critical factor which ties the components together.

One of the benefits of embracing Open Systems at the enterprise or institutional level is greater accessibility of data across databases (ie. responsiveness). This entails a breakdown of traditional 'fiefdoms' of information which traditionally have mapped to the institution's organization chart.

Some managers will resist the 'openness' of the data which they have previously thought of as their own. Greater accessibility of data means that managers who are custodians of a portion of corporate data and responsible for its integrity, must be willing to share that data to others with the need to access it.

OPEN SYSTEMS
'AN OVERVIEW FOR END-USER MANAGERS'

APPENDIX I

STANDARDS ORGANIZATIONS:

ANSI: (American National Standards Institute)

IEEE: (The Institute of Electrical and Electronics Engineers, an organization commissioned by ANSI to define or specify standards)

In 1985, IEEE formed a committee to develop a portable operating system/application interface standard, which came to be known as the "POSIX" Committee.

A series of "POSIX" specifications have been issued and continue to be developed. Most computer vendors have announced that they will develop POSIX-compliant products, achieving a truly portable, standard operating environment.

ISO: (International Standards Organization)

NIST: (U.S. National Institute of Standards & Technology)

OSF: (The Open Software Foundation, a non-profit, industry-supported organization formed in 1988 to promote a portable applications environment)

OSF attempts to move industry standards into the marketplace as quickly as possible. It is not a standard setting organization, but offers verification methods and tests to ensure compatibility with standards and specifications.

UI: (Unix International)

X/OPEN: (Founded in Europe in 1984 by five computer hardware manufacturers that had systems based on the Unix operating system)

X/Open's mission is to guide and manage the process of developing a COMMON APPLICATIONS ENVIRONMENT (CAE).

X/Open has published a widely accepted portability standard called XPG, and has endorsed the base operating system interface called POSIX (see below)

OPEN SYSTEMS
'AN OVERVIEW FOR END-USER MANAGERS'

APPENDIX II

GLOSSARY OF TERMINOLOGY:

API Application programming interface

ARPA Advanced Research Projects Agency

CAE Common Application Environment (ref. X/Open)

DCE Distributed Computing Environment (ref. OSF) An integretated set of services such as directories, security, and remote procedure calls which is independent of networks and operating systems.

DME Distributed Management Environment (ref. OSF) A common framework for managing a wide range of networked systems.

XPG X/Open Portability Guide

GUI Graphical User Interface (see Windows)

MS/Windows A product developed by Microsoft which provides the graphical user interface similar to Apple MacIntosh computers. The MS/Windows product operates on DOS-based PC's. Microsoft is turning the MS/Windows product into a full-fledged operating system (Windows/NT).

OLTP On Line Transaction Processing

OSF/1 A portable operating system defined by OSF, complying with CAE, and supporting Unix SVID and BSD features.

OSI Open Systems Interconnection (ref. ISO)

POSIX Portable Operating System Interface (ref. IEEE Standard 1003)

SQL Structured Query Language A method of accessing databases which has evolved as a de-facto standard.

TCP/IP Transmission Control Protocol/Internet Protocol

OPEN SYSTEMS
'AN OVERVIEW FOR END-USER MANAGERS'

ACRONYMS AND 'BUZZWORDS'

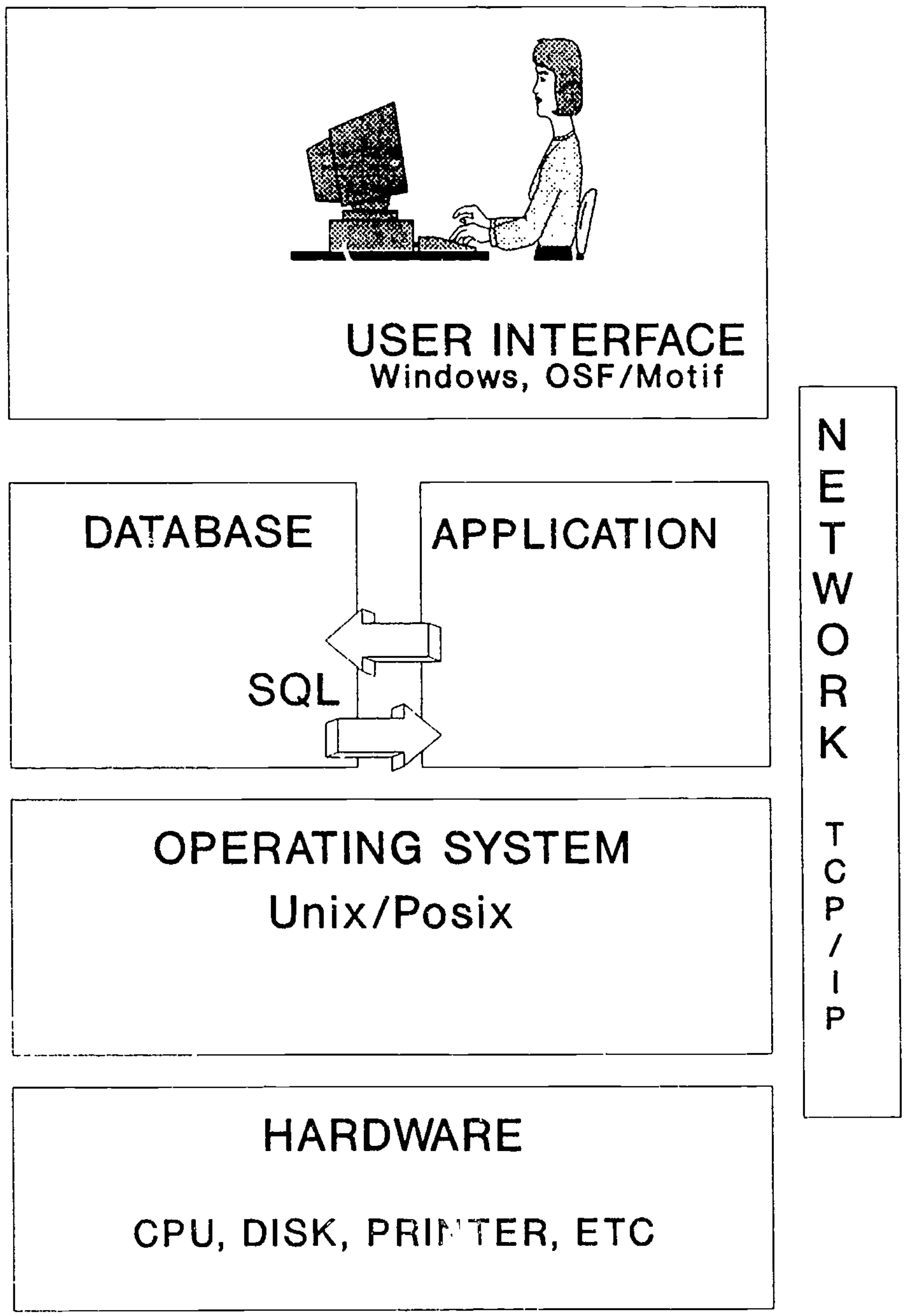
GUI	SQL	ANSI
UNIX	TCP/IP	NIST
OLTP	API	ARPA
X/OPEN	DCE	DME
OSF	XPG	SVID
POSIX	CAE	ISO

DDB Cumrec/93

Exhibit 1

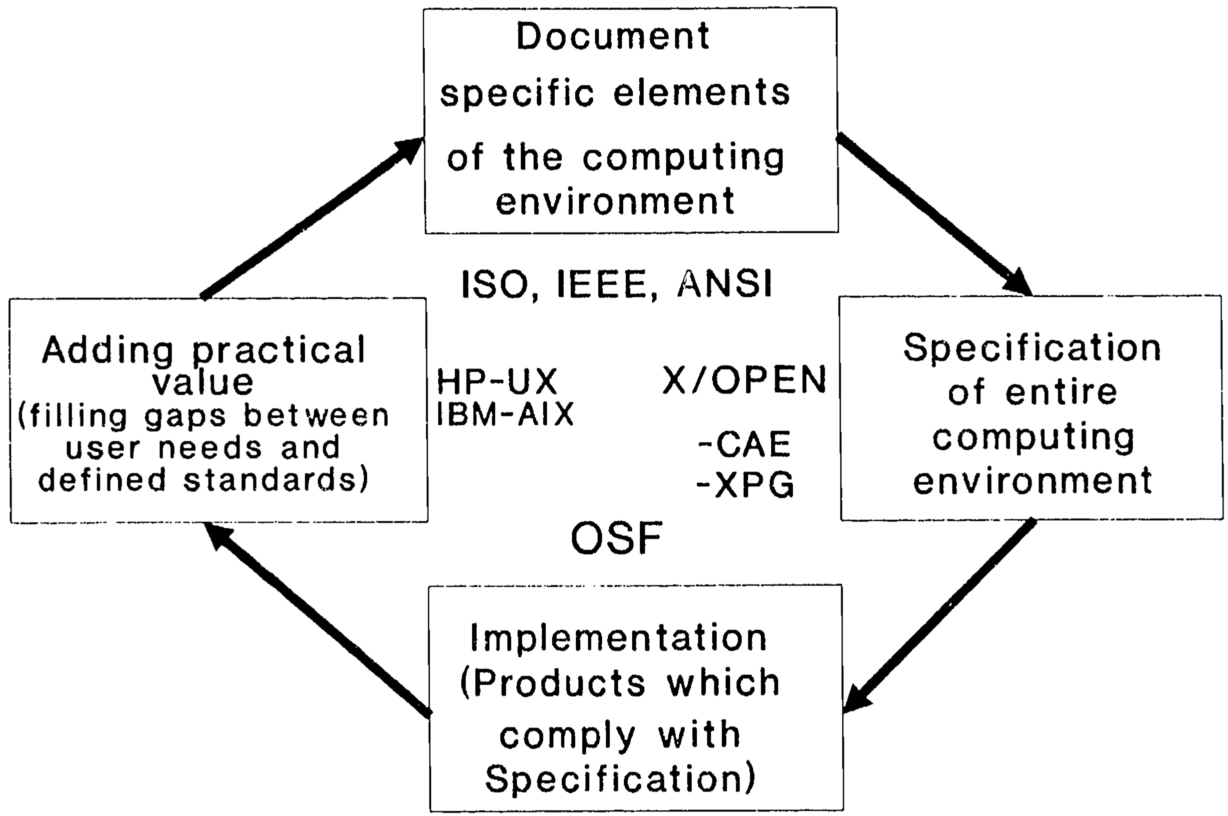
OPEN SYSTEMS COMPONENTS

Exhibit 2



OPEN SYSTEMS
'AN OVERVIEW FOR END-USER MANAGERS'

THE EVOLUTION OF STANDARDS IS AN EVOLVING CYCLE



DDB Cumrec93

Exhibit 3

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San Antonio

INFORMATION TECHNOLOGY:
The Revolution Continues

EMERGING TECHNOLOGIES

M3-5

The Networking Revolution Continues!

Gene T. Sherron
Florida State University

38th Annual
College and University
Computer Users Conference

Hosted by Baylor University
in San Antonio

May 9–12, 1993

3?0

The Networking Revolution Continues!

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I. INTRODUCTION

Networking in the Latter Years of the Information Age.

It has been a long-standing need of man to communicate. Forget the drums, bonfires, semaphores, and flashing mirrors of years gone bye. Today, managers rely on phones as the prime instruments for communications. They are simple, fast, ubiquitous, and geographically boundless. Yet, depending on which statistic you wish to accept, somewhere between 50 and 90 percent of business phone calls go unanswered on the first try. This annoyance, plus a general interest in reducing paperwork, has caused all sorts of people to be eager to try electronic mail (e-mail). Its acceptance is making it second only to the phone as essential office equipment. By the way, does it register in our minds that FAXing is electronic mail?

And even today, few people understand all of the technical aspects of connecting people electronically, but managers know what they want--"everything is connected to everything."[1] Yet, it is one thing for the president to tell us to get connected, and quite another to be implemented. So, how do we get our arms around these issues? Perhaps, what we need is a quick cram course on e-mail and its associated technology. The techie stuff includes such things as local area networks (LANs) to hook-up the offices and the software (operating systems and protocols) to drive these systems. Thus, we end up with a bit more on our plate, but at least a half a dozen topics are critical to our understanding of LANs, networking, and data communications.

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[1] John F. Akers, President of IBM, Communications (Chicago: Time-Life Books, 1986), p. 8.

II. NETWORKING

Some defining--Doing some networking? Whether we call it *networking* or *local area networks* (LANs), selecting the scheme for your campus is no simple task. Today's networking/LAN marketplace is crowded with at least fifty different vendors, all claiming that their product is THE one you need. Further confusion occurs because there are few standards in networking, de facto or otherwise. Nonetheless, you may be sure that the simple, small LAN you install today will turn into a large, multifloor, multibuilding, or multicampus network in the not too distant future.

In terms of size, the network will only *grow*. The multivendor approach will likely become more *multi*. The applications we run across the network will continue to vary in *diversity*. And, the *unpredictable* usage will be the norm.

In a formal sense, a *network* is one or more communications circuits and associated equipment that establish connections between nodes (users).[2] (Unfortunately, you'll have to wait until later in the paper to fully appreciate some of the words in this definition.) In terms of the technology that makes a *local area network*, it can be said that a LAN consists of some hardware, software, cabling, and connectors. The *hardware* is typically a PC and some added internal electronics. The *software* comes to us from dozens of vendors that provide a LAN operating system and applications software products. The *cabling* can be twisted pairs, coax, and/or fiber. And, *connectors*-- such as interface cards, transceivers, and cable connectors-- provide the linkages between the nodes and the medium.

LANs have proven their value in organizations that range in size from small offices to far flung university campuses. By definition, most *local* area networks connect users within a single building. Yet, as they become more and more popular in an organization, LANs expand to adjacent buildings. And before you know it, connections are needed beyond the LAN to a city or metropolitan area network (MAN) or even to national and international networks or wide area networks (WANs).

Rational behind LANs--A well-designed LAN can deliver many important benefits. First, it allows users to share organizational resources such as databases, graphic devices, high-speed laser printers, and mass storage devices. Such sharing can increase the use of scarce resources, improve individual productivity, and promote efficiency. It might even allow us to place less emphasis on making and filing paper copies and, as attitudes change, may even reduce intraoffice paperwork. Now, let's get into the details.

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[2]Stanford H. Rowe, II, Business Telecommunications, 2nd ed., (New York: Macmillian Publishing Company, 1991), p. 365.

III. TOPOLOGY

As networking progressed, it became evident that names would have to be given to the different methods of getting all these users wired together. You'll hear people refer to these grand designs as *network architecture,* or the more functional title of *network topology,* or *cabling configurations--as some prefer.*

More frequently, people like the phrase *wiring topologies,* so that will be our title for this section. The basic topologies are: *bus*, *ring*, and *star*. However, in practice, we find a number of wiring schemes that are mixtures of these basic topologies.

Networks with the *bus* topology sometimes are called backbone networks because they connect each device to a central cable called the *backbone*.

IV. MEDIA

Our LAN's electronic transmissions move over highways of *cables*. These cables are the different media. We usually think of cabling as copper wires, but more recently, glass (optical fiber), is gaining popularity as a LAN medium.

LANs are typically cabled with copper and it comes in many varieties. But, one observation at the outset: There is no one best cable for LANs!. As suggested earlier, the medium for your campus may be a matter of historical consequence or thoughtfully chosen, based on present and long-term requirements for data, text, graphics, voice, image, and video.

Media selection is a very important aspect of LAN developm.ent. If you choose incorrectly, the LAN may not be able to support future loads or may introduce reliability problems. Some of us get "stuck" with an existing cable plant that would cost millions to dig-up and replace. This wire that stretches from the wiring closet to the end user, or the horizontal wiring, represents about 85 percent of the cost of any rewiring program. So, with so much of it already in place for the phone system, you can bet that *unshielded, twisted-pair copper* will remain the horizontal medium of choice during the coming years.

V. NETWORKING STANDARDS

The Need for Standards--Back in the 1950s there were no rules, let alone standards, for data to be communicated. In fact, the need for one computer to talk to another computer just did not exist. But, over the years and decades, networks and telecommunications systems evolved, people in the business realized that each system should continue to be unique and specially developed.

LAN Standards (The 802 Committee)--Because our LANs tend to spill over into national and international networks, several professional organizations have initiated efforts to standardize various aspects of networking. The work of the Institute of Electrical and Electronics Engineers (IEEE) 802 Committee is the best known for LAN standardization efforts. Since it was founded in 1980, the 802 Committee has approved a standard family for LANs and established several different network access protocols. A few of the more significant ones are highlighted below:

1. **802.3 CSMA/CD and Ethernet**

This standard addresses a variety of CSMA/CD architectures that are generally based on *Ethernet*. One of the early subcommittees, it began with 1BaseT and is progressively working on other developments:

1BaseT -- The early one is referred to as *1Base5,* which means 1 Mbps across a baseband medium with a maximum length of 500 meters. This standard encompasses the more commonly known implementation named *Starlan* by AT&T.

10Base2 -- Gaining recent popularity is *Thinnet* or *Cheapernet,* or a 10 Mbps baseband segment of up to 200 meters.

10BaseT -- The renaissance of *copper twisted pairs* has been sparked by this standard of 10 Mbps baseband signals.

2. **802.5 Token Ring**

Token-Ring is IBM's LAN methodology which features a single, baseband ring topology. It operates over twisted pairs, but can accommodate more PCs if data-grade cabling (coax or fiber) is used. IBM began its token-ring running at a speed of 4 Mbps. Today, you can buy either 4 Mbps or 16 Mbps Token-Ring. Shielded twisted pair (STP) type cable is the most robust installation and is preferred for all new rings. However, many cable manufacturers insist that 16 Mbps run just fine over unshielded twisted pair (UTP).

A Standard Interconnection--Internationally, in order to facilitate linking systems, a model was developed the *International Standards Organization (ISO)* which, along with several telecommunications vendors and CCITT, that became known as *open systems interconnection (OSI) reference model.* Since 1978, work has been underway to convert the model into a set of standards by precisely defining each part of the layers of the model. The architects of the ISO-OSI model had as their primary objective to provide a basis for interconnecting dissimilar systems for information interchange. The idea being, if they defined the rules or protocols of communication, and if followed, incompatible systems made by different manufacturers would be able to "talk" to each other. As open systems have risen to the forefront in networking, standards are currently evolving from two directions *Open Systems Interconnection (OSI)* and *Internet.*

The Open Systems Interconnection Model

CCITT X.200 is the designation for *Open Systems Interconnection* (OSI) which is referred to as the Basic Reference Model for open-systems type of networking architecture. Announced in 1978, the OSI model uses a layered approach, with each layer representing a component of the total process of communicating. One way to view this model is view hardware on the bottom or layer 1. At the top is software or layer 7. In between are varying amounts of each. All of the layers in-between describe the standards that handle the necessary elements of control.

The bottom three layers--Physical Link, Data Link, and Network Control--of the OSI model are well-defined. Standards have been written and agreed to. The combination of the first three layers is the *X.25* standard for data transmission used in *packet switching* networks. As one moves on up the scale of the layers, the complexity seems to grow. Many standards are required to address all of these areas and the work will go on for years.

Future Directions--With less than two percent market penetration, OSI's future does not appear bright. Adopting certain parts of OSI will provide added value to users; and for some even full OSI implementation will be of value. The lower layers of the OSI model have provided for better multi-vendor connectivity and internetworking. And such standards as X.400--the *de facto* standard for electronic mail--and the emerging X.500 may become THE standard for directory services.

VI. LAN ARCHITECTURES

Ethernet--As discussed earlier, *Ethernet,* is one of the three oldest architectures--token bus, token ring, and Ethernet. The original implementation was with coax or thick Ethernet. Today, in addition to shielded "thick" coax, which supports devices up to 500 meters, *Thinnet* or *Cheapernet* coax is about half the size of regular coax. However, it reaches out only about 185 meters. The two sizes of coax offer the advantage of using thick coax for a backbone application, with "skinny" coax being used as spurs to buildings. Still the dominant LAN architecture, Ethernet's growth is directly tied to the price of adapter cards (network interface cards) which has run at a 40 percent increase a year for the past several years.

AppleTalk--Second in popularity in campus LAN architecture, *AppleTalk* is increasing in numbers in the workplace. To facilitate this occurrence, Apple builds its Macs with internal network interface cards and the software to support what it calls *AppleTalk*. Using either Apple-provided *twisted pairs* or coax, this unique "standard" supports up to 32 Macs or printers at a relatively slow speed of

230 Kbps. Designed with a CSMA/CD type of access protocol, its workstations can be arranged in a *bus* or *star* configuration. Interfaces also exist that allow Macs to connect to LANs having IBM PCs or clones.

Token-Ring--Growing almost as fast as Ethernet, IBM's LAN product is *token-ring*. It dominates market share in the sale of IBM token-ring adapter cards. These cards generally conform with IEEE 802.5 using *baseband* transmission on either shielded or unshielded twisted pairs. A network interface card (NIC) is used to connect the workstation to the token ring on one end. A multi-station access unit (MAU) is used to interconnect 4, 6, or 16 users to the network.

ARCnet--As mentioned earlier, *ARCnet* was developed to connect minicomputers. It uses a *token passing bus or star* architecture but does not conform with the IEEE 802.4 standard. The reason is simple. It came in to being almost a decade before standards were even developed. ARCnet is one of the more popular LANs because of its early availability for PC-based LANs, relative low cost, flexibility, and well-recognized *de facto* standard.

Starlan--*Starlan* has been standardized by the IEEE 802.3 subcommittee under the 1Base5 standard. Using the CSMA/CD access protocol, it can support an unspecified number of nodes on a cable up to 500 meters long. Starlan is an AT&T methodology, star-oriented, and provides 1 Mbps speed. One early advantage of Starlan is that the scheme uses plain old twisted-pair telephone lines that are already in most buildings. Also, it uses the CSMA/CD scheme and accepts multiple operating systems to include MS-DOS and UNIX.

Future Directions--One need not look too far to find evidence of the effect that *unshielded twisted pairs of copper* has had on the LAN marketplace. Recent market reports show that over 60 percent of all new *Ethernet* sales are using UTP cable. Imagine, over 6 million Ethernet connections will be made this year. The *10BaseT* standard has worked its way ahead of *Token Ring* with price driving the buying decision. 10BaseT can be purchased for approximately $275 per port, compared to $500 to $700 per port for Token Ring.[3]

FDDI networks operating over copper or *Copper Distributed Data Interface (CDDI)* at 100 Mbps are predicted to throw traditional Ethernet and Token Ring networks from their current leading market position by 1997. Spurring the takeover are faster PCs and resource-hungry applications such as imaging and full-motion video. The acceptance of copper versus fiber is a matter that it is cheaper, and most people already have lots of copper. At issue is how long it will take the American National Standards Institute (ANSI), which has been

[3]Gary A. Howard & Frank X. Mara, "Design a Copper Network for PDS and LANs Using UTP," Cabling Business, October 1992, p.10.

working for copper standards since mid-1990, to provide an ANSI-standard for product development. Expect it in 1993.[4]

VII. LAN OPERATING SYSTEMS

The issue in systems management in LANs is that of determining what level of service is required/desired. That is, do we need a network for occasional e-mail use, or are we dealing with more complex database management processes and need tightly coupled overall control because the applications span many departments and machines? In either case, we need to meet the range of user needs in a cost-effective manner.

Over the past decade or so of growing complexity in networking, users have quietly hoped for network control that doesn't appear to "control." But rest assured, the more usage and users, the more control will be needed. A *LAN*, or *network operating system (NOS)*, provides a certain transparent "manager" of the system's resources.

Novell's NetWare--The dominant leader in the NOS business is Novell's *NetWare*. Novell offers at least seven network operating systems (NOSs), as well as custom server hardware on which those NOSs run. Five of these run on IBM/IBM-compatible systems, one is for Macintoshes, and one for DEC VAX systems. One significant feature of Novell is its *system fault tolerance (SFT)* that provides an environment in which, if certain hardware failures occur, the network does not necessarily go down. For almost two years, IBM has been selling "NetWare for IBM" which gives users a Big Blue direction for now.

Banyan Vines--Banyan *Vines* is recognized for its support for large networks and network interconnections. One of the very few to run on Unix-based servers, Banyan has a distinct advantage in the market place because many WANs contain nodes that run *Unix* operating systems. Few can match Banyan's multi-user, Unix-based machines support.

IBM's LAN Server & OS/2--Although slow in coming, it appears that IBM wants you to do your data communications, multi-tasking, and presentation services via its latest versions of IBM's operating system or *OS/2*. So, mark *LAN Server* "out" and *OS/2* as "in." However, IBM versions support only IBM token rings, not IEEE standards. An *extended OS/2* version has enhanced capabilities such as the *LAN Server* and a communications manager.

Microsoft's LAN Manager--In 1991, we noted that Microsoft was failing to resuscitate *LAN Manager*. This year it is apparent that the Microsoft emphasis is

[4]Lynda Radosevich, "FDDI Over Copper Will Shake Down Ethernet," Computerworld, October 26, 1992, p. 50.

on *Windows Workgroups and NT*. Whether these products will or can take a bite out of Noveil's huge market share will be based on market acceptance of these new products.

3COM's 3+ & 3+OPEN--Founded by the inventor of Ethernet, *3Com* has been a leader in LANs from its very beginning. The latest 3Com offering, *LAN Manager*, runs under Microsoft's OS/2. 3Com's *3+Open* is the OS/2-LAN Manager product sold directly by 3Com. Microsoft also provides its own version of LAN Manager. 3+Open goes beyond just supporting Ethernet and handles token ring architecture as well. Like Novell, LAN Manager provides fault tolerance via mirrored disk drives. And, like Banyan Vines, 3Com has announced a name directory service.

DEC's Pathworks--For years, DEC has offered its own NOS, but competition has been stiff. Consequently, Digital has quietly introduced a product called *Pathworks* that walks the fine line between a NOS and DECnet. *Pathworks* ties into high-level services provided by DECnet and builds bridges to other PC-focused NOSs such as Novell's *NetWare*, Banyan's *Vines*, and 3Com's *3+Open*.

Using client and server software, *Pathworks* accomplishes this balancing act on the client side with PCs, Macs, and ULTRIX users getting basic mail application, network transport software, terminal emulation, and VMS application support. Server software provides users with print, file and mail services and support for TCP/IP, DECnet, and OSI. And, the server can be VMS, UNIX, or OS/2 based. The Digital strategy with *Pathworks* is to provide a corporate NOS to integrate all popular LAN technology and support all standards.[5]

Future Directions--Have you considered that the lines between *general-purpose operating systems*, such as DOS, Apple's System 7, and OS/2, and *network operating systems*, such as Microsoft's Windows Workgroups, are blurring as each acquires attributes of the other? As the number of LAN-connected PCs rises along with the network-intrinsic applications, the division between operating systems and networking operating systems is becoming less and less. Perhaps, by the year 2000, we will have merged OS and NOS!

VIII. PEER-TO-PEER LAN OPERATING SYSTEMS

Peer-to-peer networking enables users to share files and printers without a file server. Products to serve this market have been provided by about a dozen vendors for years. For a number of years, LANtastic, 10Net, Web, and TOPS have been the bread-and-butter lines for peer-to-peer networking.

Apple's *System 7* was the first major vendor to make peer networking capabilities inherent in an operating system. Novell recently jumped into the peer

[5]Kimberly Patch, "Digital's New Path for Pathworks," Datamation, June 1, 1992, pp. 73-76.

networking bandwagon with *NetWare Lite*, a low-end, peer-to-peer version of its flagship server-based NetWare NOS. In late 1992, Microsoft became the newest player to enter this market with its built-in peer networking capabilities in *Windows for Workgroups*.

Critics are quick to point out that Microsoft is not providing another peer network operating system but merely adding simple file and print capabilities to Windows. Additionally, it does not support any "clients" except Window's clients. In contrast, all major peer NOSs support DOS, Windows, OS/2, and Apple's Macintosh. However, for current Windows users, upgrading to Workgroups may be a good step.[6]

IX. NETWORK-TO-NETWORK CONNECTIONS

Transmission Control Protocol/Internet Protocol (TCP/IP)--In the 1970s, *Transmission Control Protocol/Internet Protocol (TCP/IP)* was developed by ARPA to connect incompatible computers used by military suppliers and researchers. It is a set of protocols that are compatible with the ISO/OSI reference model.

Today, *TCP/IP* is emerging as the protocol of choice for interconnecting LANs. And, it has achieved the promise of *open systems* as today's *de facto* standard for open networking.[7] Often referred to as the *TCP/IP suite of protocols*, the suite comprise a set of protocols that define a variety of network applications, for example, file transfer and virtual terminals.

While NetWare has a dominant position in the LAN-server marketplace, TCP/IP is the *de facto* standard for internetworking between diverse computing systems. One needs to consider interoperability implications between the choices of TCP/IP protocol and NetWare's IPX/SPX communications environment to appreciate the magnitude of this problem.

Repeaters--A *repeater* is used when a cable needs to be extended beyond its recommended maximum length. Because the signal becomes weakened the further it travels, a repeater is employed to amplify and retransmit the signal.

Bridges--A *bridge* is a device that can link two or more LANs to form one extended LAN that can span many miles. Bridges eliminate the distance restrictions and maximum-number-of-stations limit of LANs In addition, bridges act as packet filters and forward data that is intended only for remote LANs. Locally destined data remains local.

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[6]Caryn Gillooly, "Microsoft Marches Into Peer Net Market," Network World, November 2, 1992.
[7]Marshall T. Rose, "Network Management is Simple: You Just Need the 'Right' Framework!" Integrated Network Management, II, (New York: Elsevier Science Publishers, 1991), pp. 9-23.

Gateways--A module, or set of modules, that transforms the conventions of one network into the conventions of another (a gizmo that allows you connect one person's LAN with a different type of LAN). A gateway acts as a language translator and allows two disparate networks operating under different protocols to communicate.

Routers--A *router* is used in internets (between networks) where more selective decision-making intelligence is required to select the most efficient path for the "data's" intended destination. It ensures faster traffic flow and can automatically provide for detours if a connection is broken along the path.

Brouters--Synchronous line bridges, or *brouters,* forward packets from one LAN to another across bandwidths up to 2 Mbps. It is invisible to most protocols, so the entire extended LAN looks like one LAN.

Hubs--To wrap up this section, a few words about *hubs*. Hubs range from simple, passive devices at the low-end to multifunction devices that include integrated bridging and routing at the high-end. To qualify as a hub, it must be capable of receiving a data signal and repeating it simultaneously to multiple wires through connections call "ports."

Future Directions--The latest happenings in the "internetworking" area is what is going on with *hubs*. Price cutting is creating a buyer's market at the low end, while vendors focus on advanced features at the high end. Hewlett-Packard, 3Com, and Ungermann-Bass have cut prices such that cost per port is in the $100 to $200 range, with many offerings favoring the lower price. With 70 percent of the Fortune 500 companies using both Ethernet and token-ring networks, the vendors have responded with 10BaseT, low-cost hubs. Many vendors are incorporating bridging and routing modules into their hubs rather than require customers to by separate units. In terms of media, all major media choices are covered in today's product offerings. And, *Simple Network Management Protocol (SNMP)* has pretty much become the *de facto* standard for hub management. To describe its operation, in simple terms, SNMP agents capture device and network information and forward that data to conveniently located SNMP management stations for processing and display. Although it is greatly criticized as a light-weight protocol, it is easily implemented and requires the minimum resources to operate.[8]

One of the hottest topics in today's LAN hub discussions is *asynchronous transfer mode (ATM)*. Utilizing 53-byte fixed-cell relay transport technology, ATM is a transfer mode for switching and transmission that efficiently and flexibly organizes information into cells. It can be used in both LANs and WANs to provide high-speed (150 Mbps+) seamless integration of wide-area, campus, and

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[8]Salvatore Salamone, "The Hubbub About Hubs," Network World, June 1, 1992, pp. 47-50.

desktop-LAN transport. But, for now ATM is a "future" technology. Over the next several years, expect Ethernet, token-ring, and FDDI to continue to dominate communications to the network users.

X. CLOSING THOUGHTS

The economic proof of the value of adopting and sticking to a certain *LAN architecture* is desirable but often difficult to illustrate. Typically, each campus unit seeks to install a network at the lowest possible cost. However, the sum of these unit costs often add up to a sum greater than the whole. If we end up with *separate* and *not interoperable* or *adaptable* LANs, the campus can lose out. "*LANarchy*" costs big bucks through lost opportunities.

In closing, let us consider, "What makes networking successful?" There is downsizing, restructuring, and destructing going on everywhere. One thing is constant--*people* make systems work!

First, no matter where "networking" is located in your organization, one needs to give the *networking techie* the executive clout to carry out this important function. Secondly, the more direct the line from that *networking guru* to the organization's top technologist or manager, the greater the possibility of successful networking.

Nationally, there are over one hundred network users for every technical support person. And, when we think of their typical day, most of our "techie's" time is spent putting out our"fires" and the rest of their time is spent in the catching their breaths. Operating in such a crisis mode, we need to help the networking staff by making time for them to grow and develop their skills and abilities. Unless we help them grow in breadth and depth, job hopping will occur. Who knows, one day we might just develop structure and positions so networkers will have normal patterns of promotion and career-pathing. We are all too familiar with the saying that can be adapted to our networking staff. "Techies do not necessarily managers make." I close with this plea! As we work to develop good networks, let us adopt the slogan--"support your local techie!" Help them develop as professionals. People DO make a difference!

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San Antonio

INFORMATION TECHNOLOGY: The Revolution Continues

EMERGING TECHNOLOGIES

M4-5

Evolution of Smart Card Technology: Impact on Higher Education Information Systems

Bill R. Norwood
Florida State University

38th Annual
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Evolution of Smart Card Technology: Impact on Higher Education Information Systems

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904-644-0065

Introduction

At Florida State University we have been evaluating alternatives to our student identification card since 1985. Numerous companies and technologies have been reviewed in an effort to add functionality to the student identification card called Seminole ACCESS.

One of the keys behind the success of the project was focusing attention on how the university ID card could become a card smart enough to provide the focal point for improved and new campus-wide services. Services were interpreted to reference all facets including administrative and academic, financial and informational, as well as security.

This paper is the result of our effort to identify technology and concepts that could be used today to increase the number and types of services provided to card holders. At the same time, the technologies were being evaluated to determine if they would support a future migration to chip card technology.

We were also looking for cost effective solutions requiring a minimum of systems application and other support staff, not limited by growth, to provide a wide variety of uses. How this has been accomplished to date revolves around magnetic stripe technology interfacing with mainframe, personal computers and hand held systems.

Background

ACCESS cards in use today rely on interaction with various software applications and hardware components, which gives users the impression that ACCESS cards contain a lot of information themselves. Therefore, we like to consider

the ACCESS card a Smart Card, although most people consider a Smart Card to mean a chip card. The types of magnetic stripe applications implemented to date have been limited due to inadequate storage capacity, as well as certain processing restrictions.

A campus-wide committee for ACCESS was formed and almost immediately started asking for solutions to problems that centered around informational needs. Many of these needs focused on the way the university used the previous photo ID card. Some of the needs were to; 1) indicate whether or not the student was currently enrolled, 2) ascertain eligibility to buy athletic tickets, 3) use the recreational facilities, 4) check out a library book, 5) and enter computer labs.

The need for timely information regarding a card holder's status was apparent and if the ACCESS card was to answer these needs, a new methodology was going to have to be developed along with the appropriate technology.

Previous contacts with companies like CBORD, Griffin, Harco, Danyl and Debitek led us to believe we could use magnetic stripe technology. These were proven applications installed in campuses all over the country using proven technology, yet there were still concerns on certain aspects of these systems.

These concerns included:

1) substantial additional hardware and communication requirements because of the dependence on information from other systems.

2) an inability to use existing terminals to access student status or process transactions when maintained in other applications.

3) the requirement for substantial local staff involvement from both the systems and programming support and financial processing units.

4) non-standard coding of information on the magnetic stripe and security of information.

Many of the systems reviewed were considered too costly to implement, or did not offer the range of applications defined. All of the systems, including ACCESS, use the card to activate a specific application or to simply act as an identifier, not a carrier of information like a chip card. Present and future magnetic stripe card uses will have to continue to depend primarily on other information processing systems to give them life.

The chip card technology reviewed during this period was both encouraging and discouraging. Encouraging because of the tremendous potential indicated by the chips ability to maintain true security of the stored information and processing capabilities. Discouraging because of the high cost of the chip card and the lack of applications. The best technology is worth little without the benefit of practical applications.

Thus, what was available in the marketplace left us with a simple decision; go with the broad range of applications readily available for magnetic stripe technology, or choose the more expensive chip card technology that offered few applications and limited hardware. The decision was made to use magnetic stripe technology with a standard bank encoding scheme, which allowed a choice of vendors rather than a single system.

Old Problems/New Approach

If the best available and most affordable technology is magnetic stripe, how do you make magnetic stripe technology appear to be smart? Our answer was to first take our host based applications and allow the ACCESS card to interact with those applications in several different ways.

Some of those ways were:

1) student self inquiry terminals facilitating access to student fees, schedules, etc., could be installed if the ACCESS card could be used to invoke the existing CICS screens developed on the mainframe.

2) cashiers' office staff could use the ACCESS card to bring up the students' record when paying fees saving time, key strokes while improving services.

3) download host-based information to hand held devices which can then scan the ACCESS card to gather usage information or certify eligibility.

4) same hand held devices can be used to assist in taking attendance in large lecture halls.

5) download host-based data base with housing indicators to personal computer based campus security system. Students then use the ACCESS card to enter dorms, etc.

Everyone using the ACCESS card, students, faculty, staff, get the impression the card is doing all the work when in reality, other systems being activated or called by the card are making the decisions. Administrative offices are beginning to see ways to use the card to assist in the day to day operations of their areas.

One example of new ideas is to use the ACCESS card to print equipment check out sheets in student recreation areas. Simply have the card presented, swipe the card through a magnetic stripe wedge reader attached to a personal computer keyboard, extract the identification number of the card and the name of the card holder, then print the check out sheet with a date and time stamp.

Another example is to use the ACCESS card for controlling access to information on employers looking for student workers. Our financial Aid office operates a job locator service for students. Any available jobs are posted on a large public bulletin board located at the student union. Over half of the jobs posted for students go to non-students.

Surplus Telex terminals equipped with magnetic stripe readers and connected to the university mainframe are being installed in the student union lounge. Students with ACCESS cards will be able to look up jobs by using the ACCESS card and their personal pin number to gain entry to the information. Others without ACCESS cards or not currently enrolled will not have access to the information.

Our second answer was to allow the ACCESS card to have true financial processing capabilities like a bank card. We quickly discovered there were no chip card applications in

the financial world in either ATM or point of sale devices, nor were any planned in the near future. Therefore, our only choice was to use the encoding standards and magnetic stripe technology used in the banking world for bank cards.

Many of the old problems facing automation in the university environment revolve around financial transaction processing. Payment of fees, tuition, financial aid and cash collection campus wide all present challenging issues and opportunities.

Tremendous financial processing capabilities exist today in banks and financial service centers. By tying the ACCESS card to the financial world with a service agreement, we use the card both as a financial transaction card (debit card) and as a university ID card. The bank system handles on-line authorizations and supports the declining balance concept inherent in a debit card operation.

Access to the bank card center is achieved through inexpensive credit card readers already in use on campus and our existing administrative network (3270 SNA) connected directly to the bank center host for processing certain kinds of transactions. Other financial processing features include; posting and depositing payments, access to ATM's state-wide, electronic transfer of funds, and a card used at over three hundred merchant locations in Tallahassee.

<u>Information Systems and ACCESS Today</u>

Applications and the associated information systems are a key part of every higher education institution. With budget constraints and increasing demand for services, many of the problems needing resolution are simply put on hold. The ACCESS card concept brings a different perspective to information systems.

Our perspective was:

1) use existing applications when possible.

2) interface with other systems when needed.

3) utilize mainframe, personal computer, hand held or other speciality hardware.

4) focus on services provided through a single card.

5) use the card to generate either cost saving or revenue generating opportunities.

This approach allows information systems to utilize mostly current applications and not have to develop new ones. Existing CICS screens can be used to display information or collect money using the ACCESS card with minimal change. Commercial offerings are available to suit many specialized applications, such as security control and ID card systems. These offer the advantage of being ready to install after little or no modification, as opposed to dedicating staff for design, development and maintenance of such systems.

Information Systems and ACCESS Tomorrow

The way information systems and the ACCESS card work together today and what we expect tomorrow are still developing. As noted earlier, we are planning for the migration to chip card technology in the future. Chip card technology and ACCESS technology will soon co-exist on the same card. Recent developments are showing the card of the future (two years) using both magnetic stripe and chip card technology. Manufacturers are now making chip card readers for parking gates, newspaper racks, subways, toll roads, coke machines, stamp machines and more.

Why do we want to migrate to the chip and what are the benefits to information systems? First, we need to understand some of the benefits of using a chip card versus the magnetic stripe. Chip card readers have no motorized parts, much like swipe readers for credit cards. Without motorized movement, readers will cost approximately thirty to forty percent less and have virtually no service requirements.

The actual chips used in the cards could be DataCard chips, GEM Plus chips or others. What is important is each chip is a computer within itself, some complete with their own operating system residing on the chip and security systems that challenge any device trying to read the information contained within. Some even use sophisticated algorithms to scramble the data encoded on the chip, separate the chip into compartments like directories, and allow multiple users and applications to co-exist on the same chip.

Chip cards can have storage capacities ranging from several hundred bytes to thousands of bytes allowing data to be stores, updated, etc, each time the card is used. Memory capacity of the chip and the quantity ordered determines cost. Low end memory chip cards ordered in large quantities today cost around ten dollars each.

Information systems of the future can use the chip to transport information, track usage of facilities, control security system access, frequency of check cashing, test and class attendance and counseling notes just to mention a few. We have heard talk for several years about students carrying their transcript around on a card, perhaps that is closer to reality than we thought.

How far chip card technology has come and the variety of applications being developed today are fascinating. Imagine walking into the university testing center to take a test and the proctor asks for your ACCESS card, and inserts it into a small hand held reader. Upon insertion, the digitized imaged of the card holder is pulled from the chip in the ACCESS card and displayed on the small screen for verification by the proctor.

Self-inquiry stations using chip card technology may even become information update stations. As an example, every time a student uses a self-inquiry station, pertinent data could be loaded to or from host based systems, or information in the chip could simply be updated. The latest address on the student could be loaded to the chip and the next time it is used in a department, transferred to the departmental information system.

Paying for Tomorrows Technology

Funding new projects or technologies in higher education today is one of the challenges we all face. Convincing the university to invest in ACCESS card technology, install card readers, purchase security system, etc, will be nearly impossible unless new revenue sources are identified. We have identified several opportunities presenting new revenue sources.

Some of those identified are as follows:

Debit Card - Now that 34,000 ACCESS cards are in circulation, every student, faculty and staff member

can use the debit service offered through a financial institution. Every time the card is used for debit transactions at any of the three hundred merchants, revenue is generated for the ACCESS program.

ATM Access - Access to the many services of the banking world, such as Automated Teller Machines (ATM), has many advantages. The ATM network in place throughout the country can be used by students to access their university debit card account, saving the university considerable expense in the distribution of student refunds and financial aid. At the same time the university is saving money in administrative processes, every cash withdrawal by a card holder creates revenue for the ACCESS program.

Photo ID/Access - The new digitized photo card used for the ACCESS card costs sixty percent less than the Polaroid type picture used for the previous ID card. Flexibility of the new DataCard equipment is such that chip cards can be created in the future with the same equipment.

Long Distance Calling Card - One of the newest innovations for generating revenue comes from the ability of the DataCard equipment to print on the front and back of the ACCESS card. By adding a calling card number to the ACCESS card, the university expects to generate a considerable amount of ongoing revenue.

Campus Copier Program - With the added pre-paid value stripe on the ACCESS card, students may also use the card to make small value purchases from copiers, coke machines, etc, all over campus. Every time the card is used in one of the operations, revenue is generated for the ACCESS program.

Market Research - Useful demographic information is being collected about who buys various products out of vending machines, who uses the recreational facilities, etc.. Correctly packaged, this information has value to marketing firms doing consumer purchasing studies.

Summary

Migration to a chip card and the ensuing benefits to the university will take time and funding. Financial institutions are now beginning the integration of the chip card with a bank card. Soon, in some areas of the country, you will be issued a new ATM card with both a magnetic stripe and a chip. The intended use of the chip is for small value transaction processing in applications like vending, toll roads and subways. This will lead to applications and equipment development supporting chip card technology, paving the road for a gradual migration to chip technology.

Information systems will continue to find ways to utilize the technologies presented through the ACCESS card. New approaches for providing better services and reducing costs of existing operations for the university today will be discovered while planning for the next generation ACCESS card and the future applications.

At the same time, every possible way to create revenue streams will be explored, including forming business partnerships and consortiums to develop new applications for magnetic stripe technology and the exploration of chip card technologies. Tomorrow's new applications in higher education are waiting for us to find ways to make them either cost effective or revenue generating.

Experience to date with this program has enabled us to provide cost-effective solutions for old problems, and at the same time, implement a comprehensive card system offering tremendous opportunities in both future problem solving and revenue growth.

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T2-5

Electronic Information— Image Processing: A Step Toward an Electronic Information Environment at Iowa State University

Larry Newhouse
Wayne Ostendorf
Iowa State University

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College and University
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A Step Toward an Electronic Information Environment at Iowa State University

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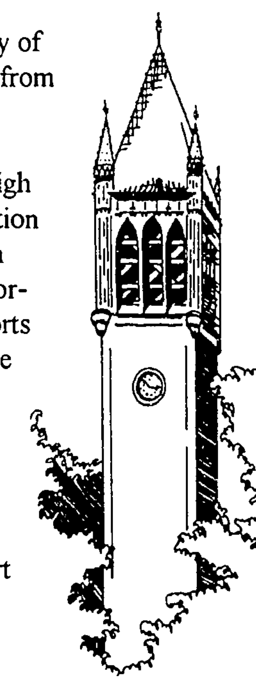
About Iowa State University

Iowa State University, located in Ames, Iowa, is a broad-based university of international stature, with an enrollment of more than 25,000, including students from all 50 states and more than 100 other nations.



As Iowa's land-grant institution, Iowa State University (ISU) provides high quality education for undergraduate and graduate students in the land-grant tradition of combining practical programs with the liberal arts and sciences. Its research in agriculture, science, technology, and other areas addresses some of the most important issues facing Iowa, the nation, and the world. Its outreach and extension efforts are creating the technology transfer and distance learning programs that will serve Iowa into the twenty-first century.

In conjunction with ISU's long-standing history of scientific inquiry and technological growth, the ISU Administrative Data Processing (ADP) Center operates in an atmosphere that fosters the investigation and application of new technology. The project that provides the background for this paper is part of that tradition.

General Theory

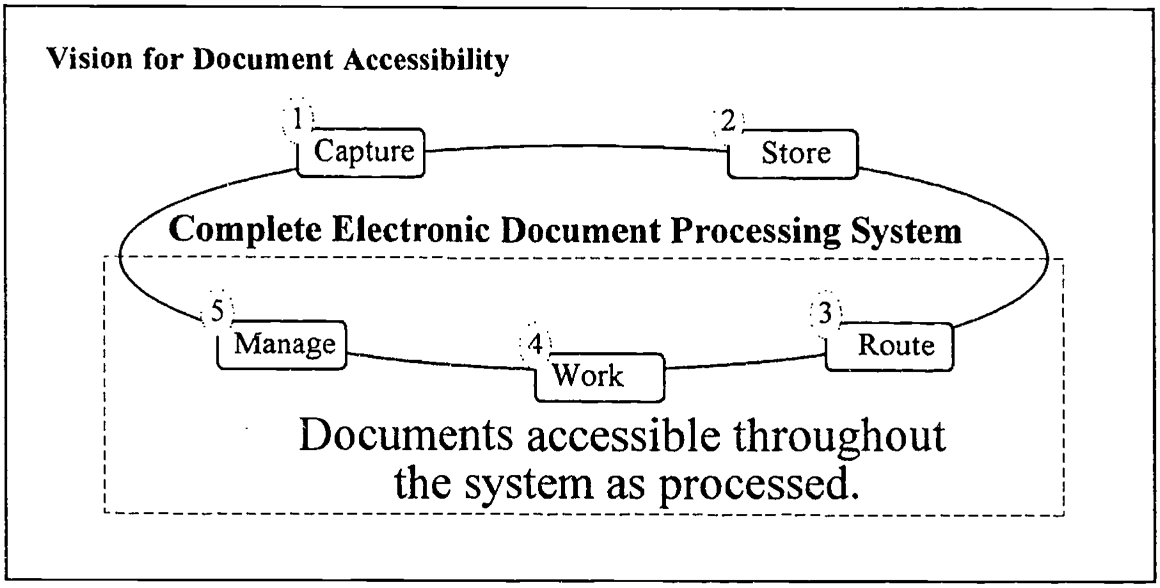
Visionary thinking about long-term strategies for handling corporate information generally focuses on a complete, electronic system to capture, store, manage, and process information.

Such a complete strategy seems relatively straight forward for many to visualize. Also, many influential organization members believe such an electronic world will probably comprise the most effective and efficient way to do business in the future. However, those of us who are in the information technology delivery business must deal with the tactical and practical aspects of directing an institutional environment toward such a vision. This paper presents the background, accomplishments, and future implications of moving toward an electronic administrative information environment at Iowa State University.

Background

Reducing paperwork has been a major objective at ISU for the past 20 years. As elsewhere, some answers for paperwork reduction, or containment, have come through microfilm, microfiche, on-line systems, and the electronic movement of data among using entities. Now we are at a point of needing to move electronic information systems deeper into the business processes of

our university to further enhance operations and to make another impact in paperwork reduction. ISU's administrative vision is to have most university documents available electronically in appropriate locations and to appropriate personnel.



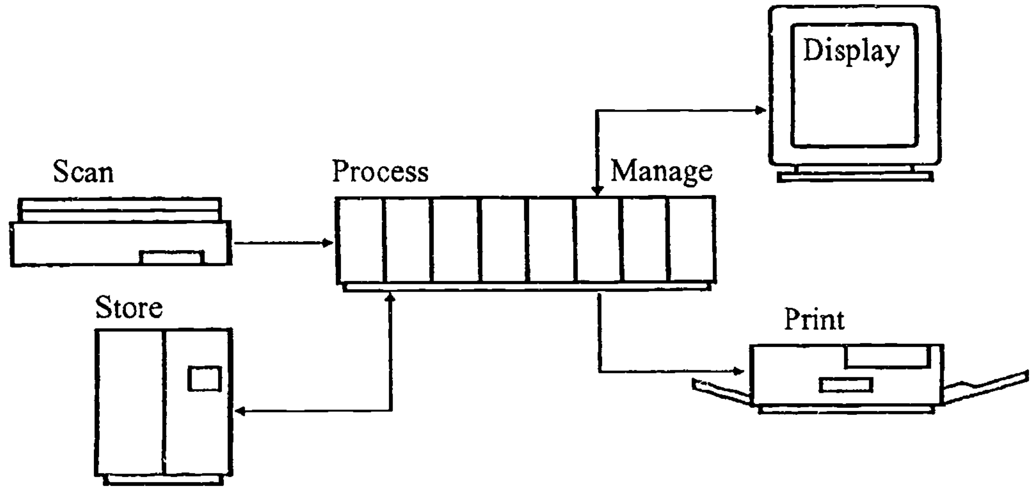
A major technical concept currently available for supporting such a move is referred to as IMAGE PROCESSING. Conceptually, image processing can be thought of as including all forms of electronic documents, such as documents created on paper and later scanned into electronic form, documents originated in electronic form but never put on paper, electronic pictures, and various other items.

At Iowa State University, image processing generally means a system that captures documents electronically and manages the business processing of those documents under computerized control. On-line applications that handle data in document form rather than some structured data form are good examples of such image processing; however, not many such complete image document processing systems exist today. This is an area that is expected to get increased attention in the future.

Another approach is that of scanning paper documents (including signatures, emblems, etc.) into the computer system and having the system handle the storage, distribution, and processing of the documents under system control. In the future, other electronic image forms can then be integrated into this approach. Such is the system the ISU ADP Center has installed as a first implementation in the University's Financial Aid Office.

This image processing system enables the ISU Financial Aid Office to electronically capture, store, retrieve, display, process, distribute, and print visual information not already in digital form. This image processing system works in a distributive processing environment in which the central processing unit acts as a server and work flow manager but does not read or interpret the content of a document.

Graphic Overview of Image Processing



Scanned Document Image Processing at ISU

During the past three years, ISU has gone through the educational, promotional, prioritizing, planning, funding, piloting, and production implementation of an electronic document processing system for the financial aid function of the University.

The educational and promotional efforts at the University were mainly driven by the ADP Center staff. The director, associate director of university systems, and key analysts actively communicated with University administrators about the possibilities of image processing and the benefits it could bring in the form of quality, performance, and long-term cost containment. The process included a literature review and productive discussions of the pros and cons of image processing. In general, this led to an atmosphere in which working together toward a common goal of reducing paperwork and improving quality became the consensus of those involved and particularly those who were to make the overall decisions to change business processes.

After a consensus was reached, several offices (Purchasing, Admissions, Financial Aid, Registrar, Accounting) were studied to determine where a pilot project using image processing would be most appropriate and have the greatest impact. This study revealed that the University's Financial Aid Office (FAO) was well suited to a project of this type, and in March of 1991, a pilot project on image processing was begun in that office.

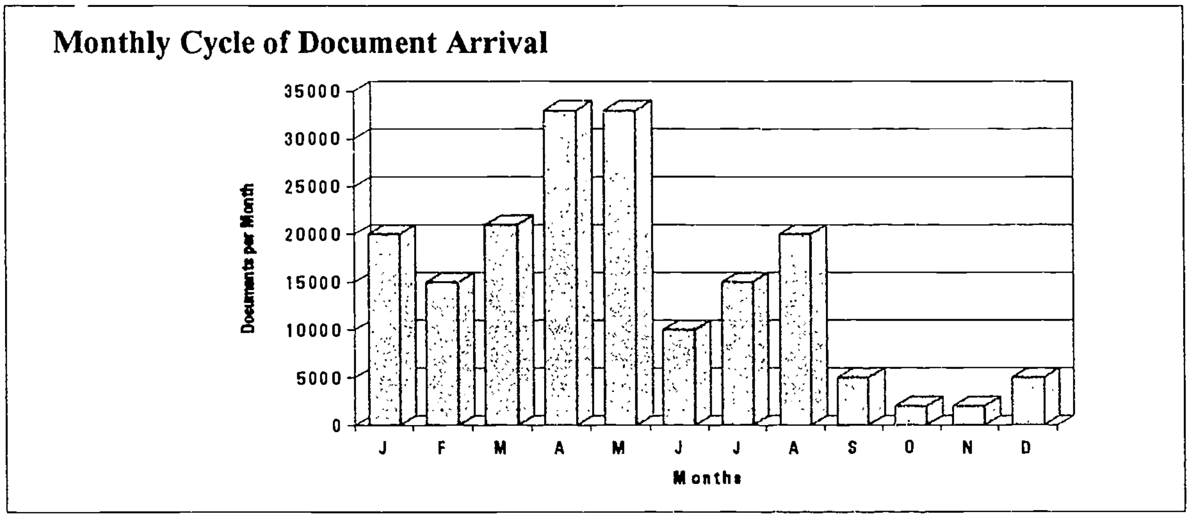
IMAGE Processing Pilot Project

As a participant in the project, the Financial Aid Office was interested in discovering if image processing was technically appropriate in its environment and in seeing if image processing could help the Financial Aid Office staff accomplish the following long-term goals:

- Enhance student recruitment and retention.
- Reduce document turnaround time.
- Make better use of staff time.
- Improve accountability and manageability.
- Reduce errors.

Paper-Based Operations in the Financial Aid Office

The study revealed that the Financial Aid Office was a prime example of the kind of office that can benefit most from implementing an image processing system. It is an office with a high volume of documents and an office that interacts with student information databases used by the Registrar's and Admissions Offices. The office handles forms from approximately 20,000 applicants per year. These forms arrive at a rate of 1,500 per day during peak application times (see the graph below). In total, the Financial Aid Office at Iowa State University receives and handles approximately 175,000 to 200,000 forms per year. In the paper-oriented system, 25,000 to 30,000 student folders are maintained, in which all documents received are filed. Each year the staff purges all inactive file folders to a second storage site where they are required to be kept for another five years.

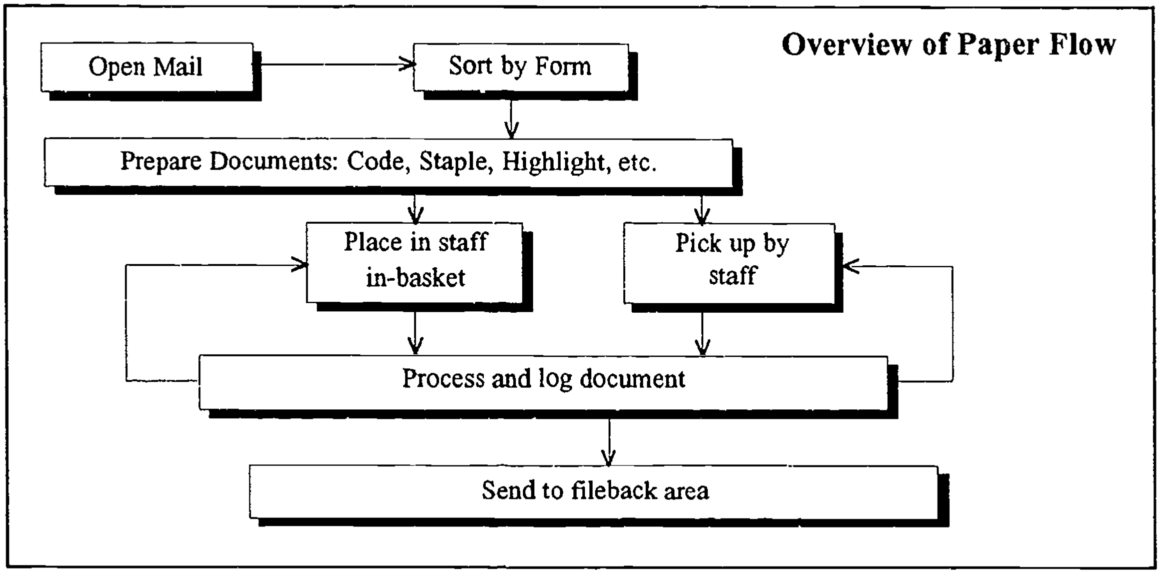


The old procedure (shown by the graphic at the top of page 5) for handling the inflow of daily mail is as follows:

1. Open daily mail received.
2. Sort and stack mail by type of document.
3. Look at each document, highlight special areas for quick visual reference, encode special processing considerations or identifying labels onto the document, and staple multiple forms together where necessary.
4. Place documents in in-baskets of appropriate office staff or functional area.
5. Have each unit pickup documents, process them (including logging the receipt of the document on the host document tracking system), and either pass them on to another office staff member/functional area or send them to the mail room for fileback.
6. Have staff work on fileback of documents as staff availability and time permit.

The volume of documents received by the Financial Aid Office makes even this simple process cumbersome, time-consuming, and error prone. The impact of this paper processing procedure on student services is most apparent in the following areas:

1. Only one person is able to access a document at any given time.
2. Documents can be misplaced or misfiled.
3. The confidentiality of the information on these documents can be compromised.
4. There is no audit trail showing where the document has flowed and what has been done.
5. Determining the amount of work in progress, backlog, and time flow of documents is difficult.



Overview of Paper Flow

Details of the Pilot Project

The pilot project entailed three tasks: defining the process, testing the process, and implementing the process on a controlled scale.

Defining the Process: Defining the process required an analysis of the size of each document to be scanned, identifying the quantity and flow of documents coming into the Financial Aid Office, and determining the length of time documents would need to be retained on each storage medium. The information gathered from this type of analysis became the basis for defining the type and amount of storage needed to implement the project and helped determine a policy for controlling document migration between the various storage media.

Possibly the most significant information gathered during this analysis was establishing how large digitized, scanned images are and recognizing how much space is required to keep scanned images available on fast-access storage devices. The table below shows the sizes of some typical FAO documents and the amount of storage needed to keep a year's worth of these documents.

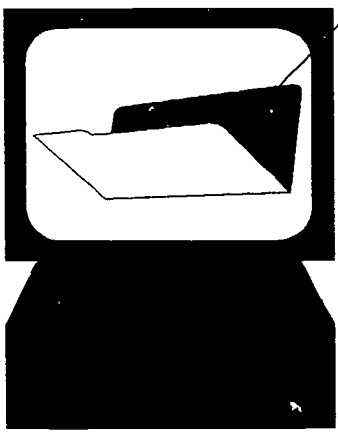
Table of document sizes and storage needs

Document	Scan Size*	Annual Number	Storage Requirements
Award Letter	56,000	17,500	980,000,000
Tax Return (State/Federal)	57,000	10,000	570,000,000
Electronic Student Aid Report	56,000	15,000	840,000,000
Transcript	43,000	2,000	86,000,000
GSL Check Letter	16,000	20,000	320,000,000
Institutional Verification Form	40,000	6,000	240,000,000
Entrance Interview Loan Form	16,000	2,500	40,000,000

* This size represents, in bytes, the 'compressed' IMAGE storage requirements per document.

Another important aspect of the definition phase was the development of an electronic student folder, which became the structural core of the document-handling process. The folder was developed with an eye on the long-term goal of having most student information available in an electronic folder any place on campus. The folder structure was based on student ID, office or functional area first responsible for the document, and the operating year of that office or area.

Structure of a Student's Folder



•Student ID
•Office or Functional Area
  Financial Aid
  Registrar's
  Admissions
  Other Correspondence
•Year (relative to the office or functional area)

Other tasks in this early phase of the project included specifying equipment (see the list below), establishing security procedures, determining document routing, and identifying document characteristics. ADP Center systems and technical support staff participated in this phase of development by installing host software and establishing network/communications protocols.

Equipment List (Numbers in parentheses indicate number of items to be used in full implementation)

OS/2 Workstations
6 (31) - PS2/57 SX (20 MHz), 8MB RAM, 80 MB Hard Drive
  8508 workstation display (19", 1,600 x 1,200 resolution)
  Token Ring Card
  Image Adapter Card

1 (3) - 4019 IBM Laser Printer
1 (2) - 2456 IBM Scanner

Physical layout - four office areas physically located on different floors

One collateral development that occurred during the definition phase was the Financial Aid Office's decision to revamp its office procedures. Recognizing that the pilot project presented a good opportunity to phase out old methods and implement new ones, staff in the FAO examined document handling procedures, including methods of identifying, routing, and classifying documents.

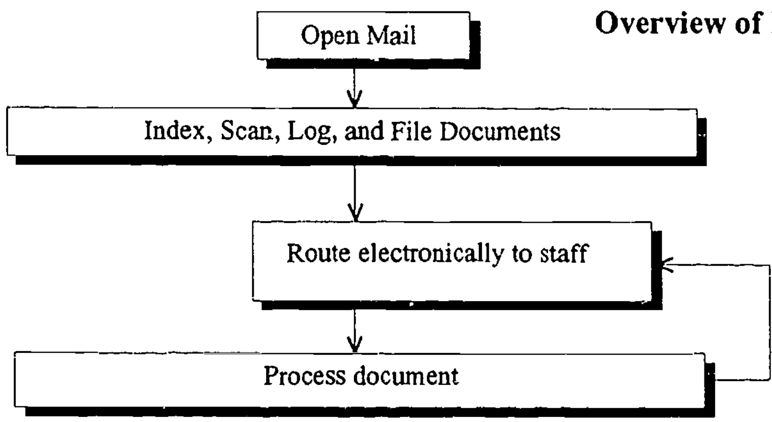
Testing the Pilot: Once the limits and needs of the project had been defined, the testing phase began. Testing included scanning all types of documents the FAO processes. During testing, special attention was paid to such details as document size and orientation, shading, paper color, and the readability of the fine print on forms.

During this phase, the typical image workstation was tested along with the host and network software. The hardware and software for the pilot project were installed during late 1991 and early 1992. By mid-1992, the testing phase of the project was complete, and the document-processing phase of the pilot began.

Implementing the Pilot Project: The implementation phase included training for one support person to run the indexing and scanning operation and training for one experienced financial aid counselor to work with the scanned documents. All documents for that counselor were scanned and then processed electronically.

The advantages of this method of implementation were the following. It limited the number of documents handled while providing a complete sample of all documents handled in the FAO. It provided a known group of documents available on the IMAGE system for all staff to view, and it allowed experienced staff members to comment on and critique the flow process.

Overview of Electronic Flow



Results of the Pilot Project

Since June of 1992, the FAO has been handling ten percent of its documents through the image scanning process. Based on the results of this controlled implementation, the pilot project has been judged successful on all counts. Image processing is being recognized as a useful way of moving from a paper-dominated environment into an environment in which documents are handled electronically and paper use is minimized.

The pilot project has shown that this leading-edge technology can eliminate paperwork and improve services in the Financial Aid Office at Iowa State University. With the technology, documents received are immediately scanned into the IMAGE processing system, automatically filed, and electronically routed to the appropriate office staff or area to answer student and office needs. FAO staff then work the documents electronically via electronic menus (see the appendix on page 11), with no paper flow in the office. With the IMAGE system, student paper folders are replaced by electronic storage.

Implementing the pilot project with the IMAGE processing system has led the Financial Aid Office to anticipate that the following benefits will accrue with a full production version of the system:

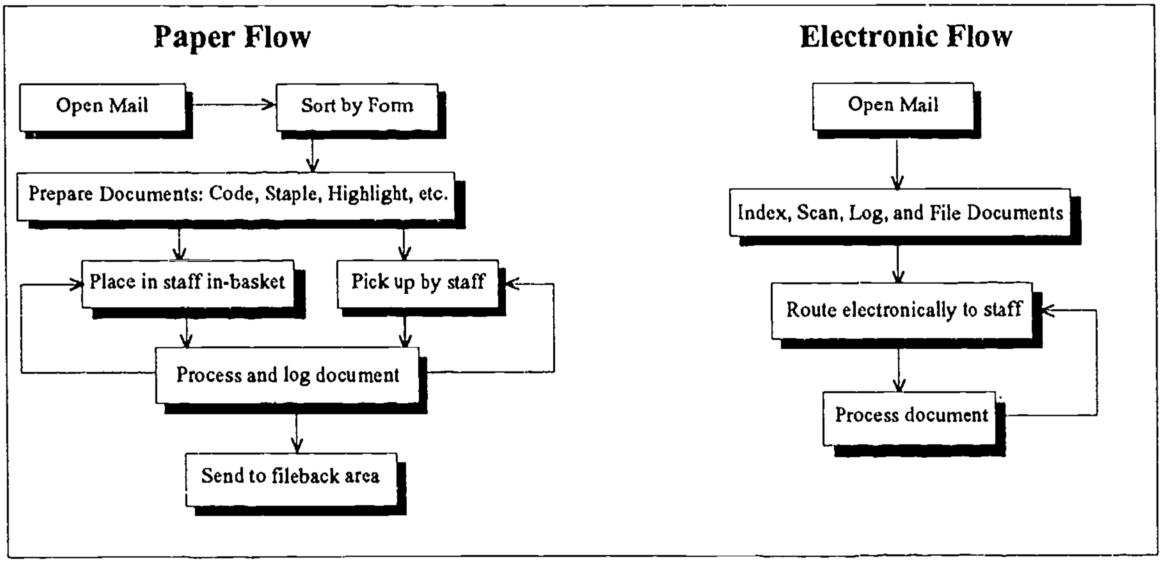
1. Quality of service to students will be improved, with quicker access to documents and document history, automatic filing and logging of documents, document security, and the availability of disaster recovery for all document images.

2. Office productivity will be increased by eliminating document delivery, filing, and refiling. All Financial Aid staff will have access to all documents concurrently so no time will be lost retrieving or searching for documents.

3. Office space will be used more efficiently by eliminating the need for file storage cabinets because no paper filing is necessary with IMAGE. Purchases of supplies necessary to support paper filing will decrease and eventually stop.

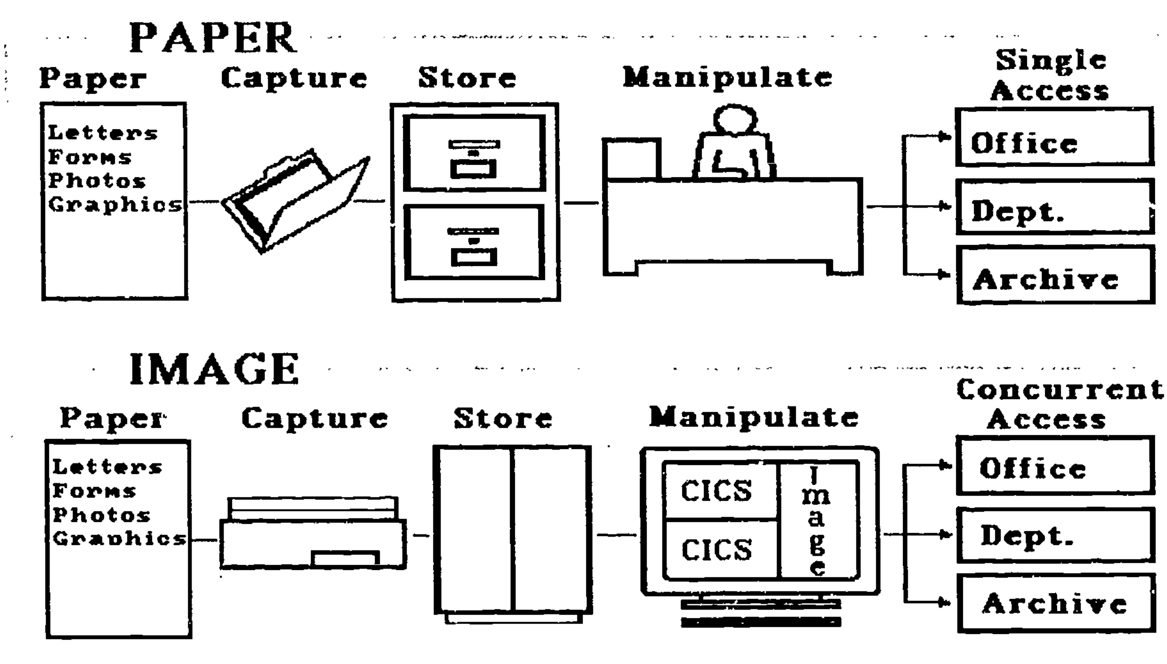
4. Documents from related campus offices will be filed in one electronic folder to give FAO staff access to all information pertaining to a student.

Overall, the Financial Aid Office believes that image processing will allow the office to meet its goals. The FAO expects to achieve an annual savings of approximately $16,000, and anticipates being able to reassign and reclassify staff to provide better service to students. The diagram at the top of page 9 shows a comparison of the paper and electronic flows in the Financial Aid Office at Iowa State University.



The main technological thrust of this innovation is that it shows the Financial Aid Office at Iowa State University can be converted from a high-volume paper office to an electronic forms operating environment, a step on the journey toward an electronic administrative information environment at ISU. The diagram below offers a graphic comparison of the paper environment and the electronic environment that results from image processing.

A comparison of the paper environment and the electronic environment



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Future Implications

The benefits of image processing have become more apparent in the last few years. Businesses with extremely high paper volumes, such as insurance companies, were the first to use it seriously. Our work shows that image processing systems can also prove to be very beneficial in a university environment. Some future benefits we foresee in conjunction with image processing are automatic data capture via Optical Character Recognition and bar-coding of source documents for faster processing. Any computer printed document or report could be automatically added to the student's folder without it ever being printed.

Image processing applies to all aspects of the university environment. The process can be applied not to only student folders, but also to policy and procedure guides, business office processes, purchasing forms, etc. The IMAGE processing system interacts with existing databases at ISU in order to verify and enhance existing student information. It is also possible to share documents electronically with other compatible IMAGE processing systems at other institutions.

The system is unique because it is fully integrated with other university databases and was developed by Iowa State University ADP Center staff through a partnership project with IBM ACIS and the IBM Des Moines Branch Office using IBM's ImagePlus software. Personnel from ISU's ADP Center, Financial Aid Office, and IBM were heavily involved in the implementation.

The IMAGE processing system is currently being used to handle ten percent of the documents received by the Financial Aid Office. The system is scheduled to be fully implemented in the Financial Aid Office in 1993.

Appendix: IBM ImagePlus System Screens

Screen 1: Sample Electronic Menu

Folder Application Facility

Select one of the following functions and press Enter.

1. Get work
2. Windup
3. Folder functions
4. Document functions
5. List folders
6. List folder contents
7. Workflow functions
8. Supervisory functions
9. Sign off

Command = = > **ADOR 123456789FA1992,Awdltr**

F1 = Help F3 = Exit F12 = Cancel

This screen illustrates the main functions of the ImagePlus system. At the user's workstation, the **get work** option displays the next image in the in-basket that is ready to be worked. The **windup** option completes the work on a particular image. Options 3-6 allow the operator to view folders and documents on file and perform various functions, such as update, delete, move, and route. The **workflow** option allows personnel with appropriate access to view the workflow of any folder or routing queue. Through the **supervisory** option, a user's profile information or workflow assignments can be viewed or updated. The user also has the option to enter shortcut commands, such as ADOR (add document and route), to perform a function without using the menu structure. The command shown in screen 1 would skip screen 2 and display screen 3 directly.

Screen 2: Sample Document Function Menu

Document Functions

Type information, then tab to the menu selection field and select an option. Press Enter.

Folder ID . . . 123456789FA1992
Form number . . **awdltr**
User exit data

1   1. Add and route document
2. Add document
3. List folder contents

Command = = >

F1 = Help F3 = Exit F12 = Cancel

This screen would appear if a user selected options 3 or 4 from the menu shown in Screen 1 above or left the document name (awdltr) off the command line entry. The folder ID is carried forward from the initial screen if it was entered on the command line. The user would need to enter the document name (awdltr), any user exit data, and the option. Choosing option 1, which is the normal choice when processing a document, would result in screen 3 being displayed.

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Screen 3: Sample Add and Route Document Screen

Add and Route Document 123456789FA1992

123456789 SMITH JOHN DEAN DES MOINES IA 03330

Type information and then press Enter.

Form number . . : AWDLTR Security class . . . 01

File tab . . . . . PRE-DSBS Date received 12/16/1992

User defined date

Paper kept . . . . 2 1. Yes 2. No

Description . . . Award Notice

Comments . . .

Do you wish to route? . . . . . 2 1. Yes 2. No

Routing line of business . . . SF

Transaction type . . . . AWDLTR

Temporary ID for scanning . . : 534472

F1 =Help F3 =Exit F6 =Routing details F12 =Cancel

This screen is completely filled out from information that the user has entered previously or that is stored on the Image system. The operator can override almost any field if necessary. If all data is correct, the operator simply presses [Enter]. The system will then respond with a 'Temporary ID for scanning' number. This is the number that will be used during the scanning operation to match the scanned image with the folder key entered earlier (ssno, office, year).

Electronic Information -- Image Processing
A Step Toward an Electronic Information Environment
at Iowa State University

Biographical Information
CUMREC '93

Wayne Ostendorf
Director ADP Center
Iowa State University

Wayne Ostendorf has been on the Iowa State University staff since 1960 when he joined the Data Processing Service as Assistant Manager. He has been director of the ADP Center since 1971 and has served on the computer Science faculty as Associate Professor since 1967. Wayne serves on various university administrative and academic committees, and interacts with various businesses and academic institutions on computing and information systems matters. He is a long time member of both the CUMREC and CAUSE organizations, serving as CUMREC Chairman of the Board, 1978; Board of Directors, 1988-91; Conference Co-Chair in 1985; CAUSE Board of Directors, 1984-87; and Secretary-Treasurer 1987. Wayne received the CUMREC Frank Martin Service Award in 1980 and the CAUSE Professional Excellence Award in 1984.

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Biographical Information
CUMREC '93

Larry Newhouse
Lead Systems Analyst, ADP Center
Iowa State University

Larry received his B.S. degree from Northwest Missouri State University in 1971 with a major in Insurance & Finance and a minor in Computer Science

Larry has been with the Administrative Data Processing Center at Iowa State University since 1972. He is a Lead Systems Analyst and has been responsible for managing the information systems of the Financial Aid Office since 1973. His responsibilities include new system design, analysis and maintenance for all Financial Aid systems including:

Data delivery/verification and Aid Packaging
Electronic Loan processing
Image processing
Voice response

Larry is one of the Project Leaders responsible for the implementation of Electronic Data Interchange (EDI) at Iowa State University.

He is a member of Midwest Association Student Financial Aid Administrators (MASFAA) and is chairperson of the MASFAA research committee for 1992/93.

Larry is actively involved with evaluation of the use of CASE tools, for application development, within the Administrative Data Processing department.

Larry is also a member of the pilot Total Quality Management (TQM) project started at ISU in 1992.

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INFORMATION TECHNOLOGY: The Revolution Continues

EMERGING TECHNOLOGIES

T4-5

The Communicative Power of Interactive Multimedia

Egondu Onyejekwe
The Ohio State University

38th Annual
College and University
Computer Users Conference

Hosted by Baylor University
in San Antonio

May 9–12, 1993

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The Communicative Power of Interactive Multimedia

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Introduction

"Today, advanced nations are beginning to build broadband communication systems with enormous capacity to carry sound, TV images, and computer data over glass fibers to every home and business. These systems will use digital 'on' and 'off' signals rather than the waveforms analogous to sound that has been the basis of telephone since Alexander Graham Bell...Familiar as the warning may sound, key industries will likely falter in nations that fall behind in building an information highway" (Schefer, 1991 p. 5).

The key words are "broadband" and "information highway." Literally, both "information" and "highway" are everyday terms. But developmentally, and together they mean far more than their sum. What to look for here is how the ability to store large amounts of data, and transmit them is integrated with the computational power of electronic computers. Consider the base of machines which are required to handle and satisfy the human visual and auditory senses, what sort of bandwidths would they have? Such machines must be able to sample, digitize, and reconstitute a high fidelity experience. These bandwidths are no longer the things of the future because they are approximated by the bandwidths we find in high technologies like high-definition television (HDTV) and digital audio compact discs (CDs). The current Audio CD standard of 0.2MB/second suffices for the bandwidth required for both auditory and oral communication. The requirement of 0.4GB/seconds bandwidth for stereoscopic high resolution television is the basis for video data. These types of input bandwidths are the widest types of video and audio bandwidths in current use today.

Coupled with massive storage techniques computing is, thus, forging ahead into the dawn of a new era with stunning, and previously unthinkable capabilities and potentials. One can hardly gainsay the fact that both information and computing technologies are at the frontiers of the twenty first century! Among the latest mysteries and perplexities associated with computer media, especially image-based media, are how to resolve the deep puzzle of reality. Computer media have become not only complex and multifaceted, but are also intriguing. Current fascinations with it as a medium are associated with different types of modern technologies such as Artificial *Reality, Cyberspace or Virtual Reality* which provide information in three dimensions; *Optical Technologies* - including laser as in Videodisc/Laserdiscs and CD-ROM, among others; *Multi-Media* and *Interactive Video* - with an infusion of sound, images, animation, video and words or text; *Artificial Intelligence* - Expert Systems, Natural Language Understanding, Speech Recognition, and Neural Network systems; and *Robotics*. We do really live in exciting times - not only because of what is available, but also the challenges that face us each day in the choices we make as information systems builders and deliverers.

Surely the information revolution has affected the various aspects of modern living. Arriving at this information age required overcoming many institutional climate and cultural roadblocks, technical problems and economic hardship. If we could pause for a minute and articulate *why the revolution*, we shall arrive at the conclusion that the revolution was inevitable. But then, what did the revolution bring? What is its impact? What has changed? Neither time nor space permits an exhaustive discussion of these issues. Suffice it to say that first, the way we *receive* information and *send* information has also changed; second, the way we *store* data/information has changed considerably; and third, and perhaps most important, the way we *conduct business* has changed.

Three major examples (electronic publishing, visualization technologies, and multimedia) are used to illustrate these points. (A fourth and an emerging technology, virtual reality is briefly discussed as a *promise* near the end of the paper). We begin with *electronic publishing* that has made possible an emerging industry in its own right, and that includes *electronic production and electronic distribution*. Electronic data can be made available through different types of network facilities such as global electronic libraries, on-line access and database search services. So, the information you need is at

your desk when you need it and how you need it! Another major source is through *visualization* and scientific visualization, in particular, bombards us with images and animations ranging from simple scientific processes like the emergence of a butterfly from a pupa, to planetary exploration, scientific simulations and reconstructions which, to say the least, befuddle the mind. Video technology tops the list in the visualization arena, and has played a key role in this information age. As if these technologies were not revolutionary enough in and of themselves, there came the penultimate world of *media integration*, known in popular literature as *multimedia*. (I believe the ultimate is virtual reality!). Simply stated multimedia is a mixture of different *monomedia*. Think about this for a minute...a technology mix of video, audio, graphics, animation, and text...and you can appreciate the power inherent in these media sources, individually and collectively, in any combination. As a matter of fact, one of the challenges of multimedia is how to navigate the maze of combinatorial mixes that range from type of text, to color mixtures to arrive at media mixes that make the most sense in a given context.

The thrust of this paper dwells on the salient features or factors which make multimedia so powerful and so irresistible as a modern delivery or communications medium. Illustrations are provided where necessary from the major experiences we had in building and putting in production four multimedia systems at The Ohio State University. A fifth project is underway. While it was no easy task, our experience will show how we tapped into the communicative power of multimedia, making it interactive (that is leveraging the inherent power), by allowing the user of the system to take charge. So, power and system control reside with the user!

The paper begins with this introductory portion. This is followed by a subsection which explains what interactive multimedia is. The next section deals with the sources of power to interactive multimedia, followed by the mission and the challenge we faced at Ohio State. The section on our experience and strategies follows. The paper is concluded with the section on the promise, and a wrap up.

Putting Interactive Multimedia In Perspective - What is it?

The basic building blocks of interactive multimedia are text, graphics, animations, audio, and video. Combining these basic tools creates a higher level of abstraction and persuasive power among

delivery systems. *"Multimedia at its best engages, cajoles, entertains and informs,"*,(Blum 1992, The world of Macintosh Multimedia p.8). So, not only does interactive multimedia integrate different communications media as no other technology has done, it also empowers the user for controlling the interaction. The major advantage of interactive multimedia is "you will decide what you'll hear and see and read, and in what combination, either simultaneously or in a sequence of your choosing. That has never before been possible, even in face-to-face human interaction," (Ted Leonsis 1992, The world of Macintosh Multimedia p. 4). Therefore, interactive multimedia is a completely new way to communicate. It is a revolution, not just the next step in communication's evolution. It is bound to make an incredible impact on people in different facets of life.

Meanwhile, the industries developing interactive multimedia tools are defining the field and establishing the *intellectual framework* in which interactive multimedia can be conceptualized. Indeed, two companies that are producing the basic tools for multimedia - IBM and Apple - have joined efforts to create systems and solutions and are creating a new environment for interactive multimedia to set the pace for similar partnerships in areas as unrelated as telecommunications, cable, publishers home entertainment and electronics.

Power sources

Multimedia has already found uses in different fields - video productions; presentations and promotions; visualization; training and education; reference materials; and entertainment. The common thread is the inherent power of this medium to communicate, plus the associated ' ma which comes with a diversity of media. But other sources of this power are related to human perception, and the tools of construction used in developing and delivering multimedia systems.

Perceptual

Perception is a direct source of power in multimedia systems. The computer, the medium of both expression and communication signals is also an integral part of the perceptual stimululi. What is communicated in interactive multimedia is *presence* - close to how humans communicate. But, multimedia engages the senses in ways which no other combination of technologies (except perhaps for virtual reality) does. *Vision* and *Audition* are two major perceptual power sources for multimedia. A third source of perceptual power, but to a lesser extent, is *haptics*. Each of these is briefly discussed.

The role of the haptic system

The human haptic system consists of subsystems which enable touch (tactile), kinesthetic (positional sensations) and motor actions. Haptics play a larger role in virtual reality than in multimedia, because in virtual reality, the user is able to touch, feel, and manipulate objects in the environment. Haptic interfaces in the way we have built our own systems are limited to forces exerted on screens by simply touching the surface for menu selection.

The role of the Auditory system

However, one classifies the audible world, either as a wave energy or as a collection of acoustic objects, audition does impact immensely on multimedia. First, there is *spatial sound* - that can be integrated either as simulations or real spatial localization cues for interaction. In our system an audio command such as "touch the screen" can prevent possible errors. There are also *nonspeech audio* capabilities that enhance interactive multimedia systems. "In addition to spatial location, various acoustic features such as temporal onsets and offsets, timbre, pitch, intensity, and rhythm, can specify the identities of the objects and convey meaning about discrete events or ongoing actions in the world and their relationships to one another" (Gary Bishop et al, 1992). It is possible to systematically manipulate audio sources and these features to create an auditory symbology, that operates on a continuum using literal everyday sounds, or complete abstract mapping of statistical data into sound parameters. Design principles in music, psychoacoustics and acoustic determinants of perceptual organization can become the sources of the design.

The role of the vision system.

First is the *visual phenomena* - Human visual stimuli are pervasive and play a dominant role in interactive multimedia systems. This visual role is maintained in at least four different ways. There is first the characteristic *visual image*, provided either through images synthesized by computer graphics or those provided by video. Second, there is the structure of the *visual scene* that goes beyond the interface, but which deals with that fundamental biological image processing entity with the capability of distinguishing a foreground from a background, and spontaneously way aggregating parts into distinct and separate meaningful regions. So, for example, a viewer will recognize a tree as being different from a house, and both as different from the ground on which they stand. As will be demonstrated in one of our systems, a door stands out from its background.

Third, there are the *visual consequences of interaction with the screen*, that carries with it some realism about the objects that are perceived. A user of our system will, thus, see the doors open and close, or see the video simulation role and stop. Cutting, 1986, has described such visual worlds for virtual reality. A visual consequence might, thus, be described as being the spatial interpretation of visual images that is very dependent upon the kinematics (abstract motion without force or mass) of the image in motion. The nature of motion so described becomes the consequence of the user himself or herself. Indeed, while some visual consequences are necessary for perceptual fidelity, visual consequences are beyond simple visual issues because they include intersensory integration.

Fourth and finally, there is the role of visual information in discriminating among *different spatial orientations.* While a two dimensional depiction of some image in two dimensions helps to illustrate or simulate real world objects a world view in three dimensional graphics can also be used for enhancing and orienting such images with more realism. Switching from one to the other does not disrupt the orientation of the user (as would sometimes occur in a virtual world) because it occurs with dynamism.

Role of storage medium

University Systems has used interactive videodisc for the development of University Front Door Systems because of its high capacity data storage ability and high fidelity of the data. The laser disc can hold 54,000 frames on each side, enough to record 40,000 pages of text, 5,000 photographs, twelve minutes of moving footage, eight hours worth of narrated film strip presented at two frames a minute, and 1,000 microcomputer programs - only on one digitally encoded disc. Video can handle any type of information that can be recorded: print, manuscripts, photographs, slides, film, X-rays, tape recordings, all types of graphics - including computer graphics. Indeed some discs record both analog and digital data, making the potential for telecommunications incalculable. This choice has increased performance and reduced bandwidth requirement for managing multimedia data flow. The disk drive receives commands directly from the host computer, and transfers data directly to the TV screen. As will be shown in the demo, using any of our systems is almost like watching TV video - except that power now resides in the user's hands.

I/O speed Increase

We also garnered power from speed and system response. Access time for a video disc can be really brief when compared to video tapes. Because in a laser disc player there is no physical contact between the moving disc and the fixed head which reads it; the disc smoothly glides back and forth beneath the reading head. So, the worst access time is really a matter of seconds. On the other hand, in a videotape player, both the tape and reading head touch each other, and both are involved in motion, so access time can take longer because the two (tape and reading head) must disengage and the tape must wind from reel to reel.

The Mission and the Challenge

The mission

You have probably heard the adage that "any experience that doesn't kill you is useful." This is perhaps more so in the high tech area, for here practically all new initiatives at cutting edge are extraordinarily susceptible to Murphy's Law. The major thesis of this paper is to illustrate how different pieces were put together to communicate content in a very coherent and powerful way. It was a journey intothe unknown, but we have made inroads. We began anexpedition that presented us with an alluring end state, a place of beauty and a place undreamed of only a few years ago in the information technology industry. But, we had no road maps, and we had very little resources. All that we were told was that there were tools existing all over the computing and information technology world. The new place we saw was the exciting world of interactive multimedia. There were several live demos to show that it is *feasible*, but more importantly that it is also *necessary*. Our mission and our challenge was not just to arrive at the enchanting land of multimedia, but also to use the medium for promotional purposes. We were charged with the mission of using such a technology to get across university ideas to a population base that was a moving target!

You are probably asking by now *what does the deluge of high technology have to do with a University Administrative Computing Department such as University Systems?* It is unusual for a major university administrative computer processing organization to reflect upon these new technologies let alone get involved in using them to provide services. The multimedia project at The Ohio State University Systems started as a vision of President E. Gordon Gee who has now charged us with providing administrative computing services through

the path of cutting edge technology. So, President Gee has already laid the foundation through which administrative computing can make a major technological leap into the twenty-first century!

Such a group of services will be delivered by way of what shall be called *"The University Front Door Systems."* The two major attributes of the content of what we were charged to deliver were *factual* information about the university; and *captivating* and/or *entertaining* type of information. The part on factual information is intended to present the basic, yet, salient facts about the university. This is not merely a listing of statistical data, but the presentation of data in such a way that they are relevant to the visitor's or user's needs. Such things as the university's academic excellence, reputation and location, its faculty, staff, student life on and around campus, facilities, and cost are essential for both a potential student and his/her parents or guardians.

The entertaining or captivating information was the more intriguing of the two types of information. It had a dual purpose. The first objective of such information is to *seduce* the systems' user. Essentially, this deals with the systems' delivery mode/s and interface design. If information is clearly depicted in graphical and easily understandable form, the user will find the system user-friendly. Additionally, information can be presented in a form that challenges the user's other skills, as in computer games. The second objective of captivating the user is to feature some or highlight some of what makes The Ohio State University a highly reputable place. Thus, the information in this area will include both academic and non-academic achievements.

The Challenge

But while interactive multimedia holds so much potential, it does present enormous technical challenges. The challenge came with all the variables associated with developing any interactive multimedia system worth its salt. There was a shift for us, because rather than remain the "utility" data keepers of the university, we suddenly catapulted to different heights. We became engaged in marketing, image making - and oh well - artistry, video technology, photography script writing and much more in the artist's world, while remaining programmers, scientists and engineers! When you become, or are expected to become, all things to all people, you begin to wonder if anyone really took time to define your job description. Recently, I came across one way the challenge can be explained. It stated, "you speak with many voices - the voice of the corporate executive who

wants performance and investment protection; the educator who is looking for economy and functionality; the sales rep who needs portability and ease of use; the engineer who demands performance, power and speed" (Z DIRECT, Zenith Data Systems, Summer 1992).

In the block's world, the components of interactive multimedia are text, graphics, animation, audio and video. These monomedia are not simply bundled together. While a video source and the source for still images can be video cameras or VCRs, some knowledge of video and even lighting techniques may become necessary. This is a far cry from skills required, for example, to use animation to illustrate a complex subject. This requires not only animation skills, but also the skills of an artist. At that level, you will need to find more sophisticated software, one higher in sophistication than hypercard! You then move to color, only to find that the biggest challenge in having true electronic color intact is how to get from RGB to CMYK. "Any desktop publisher who's worked with color can tell you horror stories about colors that looked fine on screen but came back from the printer transfigured - greens that turned gray, blues that went purple, and flesh tones that developed a sudden case of jaundice...The culprit isn't the printshop. When it comes to color, you'll find scanners, monitors, and printers don't speak the same language, and when you try to communicate color information from one to another, something gets lost in the translation," Bruce Fraser, 1992.

Then you move to data storage - if you scan one color image, you will need more than 2 megabytes of storage, which is more storage than you have on a single floppy disk. If you record one second of sound, you will need anywhere from 5 to 22 kilobytes. You, therefore, need more than one megabyte to store a good medium quality music that lasts for 45 seconds. So, to state the obvious - your multimedia data or information imposes enormous space requirements that worsen as more information or data is needed for updating. As the data increases, your space requirement increases exponentially. Well, even if you have taken care of the data storage, you should be able to retrieve it when you want it with ease and fidelity. So, to retrieve your data you need to consider time - basically retrieval speed, based on your application. For data based issues alone the set of problems for multimedia, thus, include: one of storage, cost, access rate, data conversion, and data compression and decompression as well as reliability (based say on failure rate, static electricity and other ambient factors).

To do anything to the movie, the movie must be moved from its analog source such as VCR or TV to the computer, and then be digitized say into QuickTime's Movie format. Among the Apple products required for capturing video from its source and digitizing it are SuperMac's VideoSpigot. The editing products (once the movie is captured in the mac) are DiVA VideoShop and the Award-winning Adobe Premiere. Either can be used to "splice different sections of the digital film together, add titles, graphics or special effects." Other tools available can be used to animate any given QuickTime movie - something not possible with digital video.

Our Experience and our Strategies

What President Gee charged University Systems with on June 14, 1991, therefore, was to develop a multi-media computer package prototype that uses a combination of high technology to reveal the essence of The Ohio State University as a leading institution for teaching, research, public service and much more. According to President Gee's Assistant John Elam, "The University Front Door Systems is one way to invite *the visitor* to explore this great university. Who is to say or measure all that we have lost in the way of funds or good students, simply because these people could not find a place to park, and did not know whom to ask nor where to get this information?"

Any University Front Door Service must accommodate the caliber and interests of high school students and their parents and/or guardians whom The Ohio State wants to attract. It should challenge as it educates, it should attract as well as tell what makes this a great institution and one to choose. "We must be involved in the public schools to ensure that the students have high expectations of themselves and of the education they will receive at The Ohio State University," President Gee said. "We must challenge ourselves by bringing the best and the brightest students to our campus to engage us in intellectual dialog," he continued. This means that a Front Door system should enable the student/visitor to perform initial screening of why they are on campus, as well as proceed in the direction of interest to them. The person staffing such a place should have enough information about the university to support information from the system. Moreover, the person and the system acting in concert must be able to quickly provide specific and accurate solutions to the visitor's problems. For any visitor to make informed choices about opportunities and challenges at this university, and/or to make

subsequent decisions about attending, or about his or her ward attending Ohio State, he or she should be able to traverse the university easily by "On-Line" means and have at their finger tips, the immediacy and provision of their informational needs.

University Front Door Systems Goals and Objectives

There were two major types of goals to be achieved: one set of goals was targeted towards people, and the other was targeted to how technology reflected upon the university. Among some of the people's goals were: to provide a one-stop shopping center of all, that is The Ohio State University; to provide accelerated learning experience and personal profiles through an encapsulated Story of The Ohio State University; to provide needed visibility for the university to enable parents/guardians and potential students to make informed choices about college education for their wards/themselves at The Ohio State University; to immerse and use all possible human senses in information processing, and present information in esthetically pleasing and easy to use fashion; and to provide a clearer picture of the essence of the university in forms which are readily communicable to the people of the State of Ohio and elsewhere.

With regards to technology, some of the goals include those listed below: to show how technology is advancing higher education; to share and highlight the salient features of high technologies and the role of The Ohio State University; to use the large size of Ohio State as an advantage, by controlling and disseminating information in a less unwieldy fashion through the powerful medium of multimedia; to enable the quick redesign and presentation of current, sudden and unpredictable changes and conditions which affect the university; to remove/reduce built-in obsolescence in systems that are the first contacts a person makes with the university; and to consolidate and enable more efficient use of media resources available from diverse departments across the university.

Strategies

With these goals in mind, we articulated certain strategies that have seemed to be very helpful. We hope to share them with those of you who may be called upon to build such systems in the future. We began by evaluating and extracting meaning from the challenge.

Strategy 1. Our first attempt was to interpret the *vision*. It is not often that staff in a university data processing department know and share a vision with the highest executive officer of the university. So

when President E. Gordon Gee shared some of his information technology visions with our unit, what was he saying - and more importantly what was he saying in the face of little or no budgetary backing? With such a rare type of support coming from the top, who could resist? The project soon gained broad base support because of its high visibility status. But as with most institutions of higher learning, Ohio State was feeling the budget crunch at the time. There was no money to build the dream system every one wanted! Meanwhile high support base and high visibility were translated immediately into the high cost of failure, and why the *project must succeed*. What were our hopes? This led to other strategies.

Strategy 2. - Form a high performance team which can cut mutually destructive contention and fragmentation, as well as reduce duplication of services. To strategize against the current tide, as well as expedite it, we had to locate existing resources on campus. Several campus units were requested to provide their expertise; and they did.

Strategy 3. - Form partnerships with the different groups/departments and, thus, move more content into the jobs. But computing and information technologies and systems are islands with divided functions. University Systems' strategy has been one of joining forces with other departments where talents and resources exist for a combined or joint venture. University Systems is also devising innovative and more efficient ways of solving university data/information needs.

Strategy 4. - Finally, we thought of continuity and obsolescence. We built shells that form the core of our systems. New systems are produced very fast because of this added value.

To date, there are four University Front Door Systems, with the fourth currently on display on campus. Each system has improved upon its predecessor. The first UFDS is at the Center of Science and Industry. The second system was designed for Ameriflora, and the third system was displayed at the 1992 Ohio State Fair. As indicated by the statistics, letters and word of mouth, these systems have been very well received. I will demonstrate one UFDS conference.

The promise

What has been discussed here are basically "kiosks." They are stand alones. Connectivity will play a major role in the future, as more

and larger data bases become amenable to the techniques of multimedia through data compression and other techniques. Questions to be resolved may well range from what data types are available, and where they reside, to such basic needs as what does a modern information user want...how can it be connected to what...at what speed....in what form...for what purpose...and the list continues. Type of network - ethernet, Novell, Netware, Banyan, VINES, LAN, WAN - will then become a matter of choice, convenience and cost.

No matter the value choices one makes now, one must leave enough room for growth because there will be the need to upgrade practically every hardware/software product/tool in use. Interactive multimedia systems' tools are not yet in a mature market. Our own experiences have shown that we need to enhance performance, speed etc, so we have had to change processors, add memory, swap drives and so forth. In the future, we will need to build some connectivity with some form of high speed communications tools. Invariably, then, security will become a more pressing issue than we have so far encountered.

The UFDS currently displayed Bricker Hall has a three dimensional "on-line" campus tour depicting major landmarks or *major* buildings on campus, and the services which are provided in such buildings. Such tours include, for instance, the Student Unions, the Towers harboring the Admission's, Fees and Deposits', Financial-Aid's and Registrar's Offices, the Medical complex, the stadium and the Wexner Center among others.

Depending on whom you ask multimedia can be seen as "the harbinger of an era when computers will routinely convey information with sound and animation, as well as text images, and when television will become more interactive. But others see it as the victory of sound bites and flashy visuals over the printed word." (Jim Heid, MACWORLD, May, 1991, 225-232)

Today, computers and televisions seem to be progressing toward a collision or convergence course. The forecast is that both home and business will soon arrive at the era of *digital video communications* - as more people become interested in actively interacting, exploring and playing the media as they deem fit, instead of sitting passively and absorbing whatever is communicated. This means the intersection of different media, technologies, and services that not too long ago were moving in diverse and variant paths. IBM and Time Warner are

currently negotiating to create an interactive television system. The success of this will allow Kaleida (formed by IBM and Apple) to tap into Time Warner's extensive cable business, its television business and its movie libraries.

Think of the interest generated in how Hollywood and High Tech are generating conversations. Multimedia will be popping up on private FM bands, cable television stations, networks and (eventually) telephone lines. All these speculations are only the beginnings of what lies in store. Multimedia, especially in the interactive form, is will inspire more bewilderment and fascination. To illustrate the nature of this bewilderment and fascination let me just say a few words about virtual realities, as another promise of the future.

Given virtual reality, we are able with either Data Gloves, full body DataSuits, or EyePhones to explore different types of three dimensional (3-D) spaces such as NASA's space station or the landscape of Mars (while still on earth of course) or climb Mount Everest within cyberspace. A person in this sort of world is engaged in what in current literature has been called "alternate realities," "meta realities," and "virtual realities," in which he or she engages in visual experiments which not only manipulate but even disobey natural laws, as we have understood them today. The name '*virtual*' means that it does not have any existence. So, "*virtual reality*" becomes an oxymoron - symbolizing a reality which is not real! Hence, those who participate in this new computer-defined world participate in abstract spaces called cyberspaces, within which exists neither the physical machine nor any physical viewer. The question, thus, is tantamount to this: if neither the viewer nor the physical machine has existence, then who is it that views what? I will let you sleep over this one. Should you wake up and are still able to tell (where your mind is located in your body) you have completely missed the point!

Conclusion

Multimedia, interactive or not is not a substitute for other communication media. Rather, multimedia supplements traditional means of communication in a very powerful way. The power of interactive multimedia resides in its interactive and nonlinear mode of communication. (In fact, it does, by definition, render linear thought impossible). It is the closest thing to the natural forms of human interactive experience because it engages all the senses through audio, video (motion or still) animation, computer graphics and text.

What's more, the self propulsive nature of multimedia empowers the user, who can learn by digression in an enriched learning setting. Because of better representation of concepts, interactive multimedia becomes so potent it transforms a passive receiver of information into an active participant. To this end, it personalizes the information, stimulates thinking, and enables instantaneous discovery. Part of its mission in any institution of higher learning would be, beyond concepts, to communicate as vividly as possible how technology is advancing education. A byproduct of that may well be to entertain the user through this experience.

Back to the point being made about virtual reality...remember... the point is the power and complexity of this artificial/virtual reality continues to extend the puzzle of what humans have since held to be reality. The easiest way to depict a similar medium is by holograms and stereopsis. It is not delusion. The puzzle of "virtual" or "artificial reality" forces us to challenge the current posit of what reality really is. Perhaps, we shall never know; *this may well be the ultimate challenge - or at least part of the challenge.* Interactive multimedia, on the other hand, is imbued with *presence* - in essence, it has reality!

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INFORMATION TECHNOLOGY: The Revolution Continues

EMERGING TECHNOLOGIES

W1-5

Downsizing from Mainframe to Mini: A Case Study

A. Burge Troxel
Dallas Theological Seminary

38th Annual
College and University
Computer Users Conference

Hostod by Baylor University
in San Antonio

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DOWNSIZING FROM MAINFRAME TO MINI: A Case Study

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Introduction

As you know there has been quite a bit of discussion on the subject of "downsizing" or "rightsizing." I want to share with you an actual experience of downsizing. It is my hope that institutions that have similar circumstances to ours will be encouraged to proceed. For others, perhaps, there are some universal principles that could guide any size organization. Making dramatic changes to one's computer environment is a scary proposition. To change platforms, vendors, computer language, operating systems and trash all source code is not a fun thing to think about. Indeed, to alter the whole computer environment at one's campus is not an exercise for the faint hearted. However, with a blend of thinking, good fortune, and faith - dramatic positive results can be achieved.

Historical Background of Computerization at DTS

DTS History

Dallas Theological was established in 1924 to train men to preach from the Bible (a unique concept in that day). Because it is not affiliated with any particular denomination, the seminary was dependent upon voluntary gifts from individuals and churches. Obviously the Seminary had no computer Science department and the leadership of the school in many cases did not even know how to use a keyboard.

Using The Service Bureau

In the early 1980's there was a need for increased gift income. At that time the Seminary contracted with a service bureau to provide a computer assisted "direct mail" Fund Raising system. This system was written in Cobol/CICS and utilized an IBM 4341 mainframe computer.

The major application was a Direct Mail Fund Raising/Donor Management system. There eventually came to be over 400,000 names in the data base. There was also a System 3 which was used to produce letters that had a

personal look. The system also sent thank you letters for all gifts received. In the early eighties, Dallas Seminary was the leader in personalized direct mail in our market.

The service bureau also began to code some Accounting programs for the Seminary. These programs were never completely finished. They provided some limited accounting reports but were filled with bugs.

Bankruptcy Scenario

In 1983, the service bureau began to have financial difficulties. The Seminary decided to purchase the System (hardware and software) and move it onto the campus. Since the Seminary had become completely dependent upon the services that this system provided, they really had very little choice but to obtain the system. Basically all of the donor and financial information resided upon this system.

Summary

The institution had become financially dependent upon the services of a system that required the use of programs written in COBOL/CICS on an IBM 4341 Mainframe operated by an external service bureau (outsourcing). As a result of the service bureau's financial difficulty, overnight the Seminary inherited a Data Processing Department without the benefit of careful planning or counting the cost.

Experience Using the Mainframe

Expectation problem.

With the arrival of a powerful computer on campus, the staff and faculty began to expect immediate benefit. However, the system was only capable of servicing the basic fundraising needs of the Seminary.

Leadership problem.

The Seminary had no expertise in the field of data processing and no one knew anything about utilizing a computer for any campus operations. As a result the Seminary turned the department over to a student with no data processing experience.

Partially as a result of increasing pressure to utilize the capabilities of this computer the Seminary decided to automate the Registrar's office. But, because of lack of experience, they selected a system that was completely incompatible with the original system. The Registration system required the data base system DL1 while the original fund raising system used VSAM files.

Expense problem.

In the mid 1980's financial pressures began to mount at the Seminary. During this time the cost of ownership of the Mainframe continued to increase primarily due to the increased cost of maintenance which had reached over $112,000/yr.

There were additional increases in costs related to the need for hiring additional staff to handle the necessary fixes and enhancements to the various systems. Even with additional staffing it was difficult to respond to the many requests for computer service.

The PC Problem.

During this same time period there arose an increasing demand for personal computers. Departments were discovering the value of using PC's for word processing and a few departments tried to automate some of their processes using dBase software and other similar programs. This proliferation of personal computers added additional support requirements to an already overwhelmed department.

New Leadership

With the growing frustration and confusion concerning computer technology, the Seminary hired the author of this paper to try and solve the problem.

Summary

With the presence of this powerful mainframe computer, people began to expect to have automation available to aid them in their assigned tasks. However, the computer services department was not able to provide support within the cost parameters, so departments began to try to use PC's and Macintoshes to meet their data processing needs.

Circumstances Leading to a Change in the Computer Environment

As a result of the aforementioned circumstances the situation became quite intolerable, especially with the increasing financial pressure. It was clear that there had to be a better solution to the Seminary's automation needs. The problems could be summarized as follows:

1. The current mainframe system was TOO COSTLY. The high software maintenance fee, the increasing hardware maintenance expense, and the increased staffing costs had become prohibitive.

2. The current mainframe system was TOO UNRESPONSIVE. It had become simply too time consuming and labor intensive to keep up with the programming changes that were continually required.

3. The current mainframe system was TOO ISOLATED. The multiplication of stand alone PC Systems which lacked any consistent integration of data had produced a rather confusing state of affairs.

Summary

The mainframe computer environment that was inherited from the Service Bureau was incapable of providing the comprehensive computer service that was needed. The mainframe computer was costly, unresponsive and isolated.

The Search for a Solution

When these facts became distressingly clear, the decision was made in January of 1987 to find a new solution by January of 1988.

The Experiment

It was about this time that the industry became enamored with Local Area Networks. We installed a small Novell LAN in our office to experiment with the possibilities. It was clear immediately that this technology was too immature to handle the demands of a school our size. Also, there was no existing software available that would have been capable of handling our requirements.

The Consultation

During this time I asked IBM to give us a recommendation as to what we should do in this situation. Their support team came up with quite different scenarios.

The first was to upgrade our 4341 to a 9370. This solution really did not improve our situation since it did not address our fundamental problems.

The second possibility was to convert to a Token Ring LAN. However, again there was no software available for our application.

The third option was to combine a mini-computer (System 36) with the LAN. There was a software package available on the System 36 but it was written in RPG II on this aging platform.

The point is that our consultation with IBM, unfortunately, did not produce a solution that addressed our concerns. It was obvious that any solution would have to involve a completely different system from any that our trusted primary vendor was suggesting.

The Consultant

During this time the administration was growing in their frustration at the inadequacies of the computer system. Therefore, the administration hired a consultant to evaluate the situation. The consultant concluded that a mini-computer was most appropriate for DTS but there was uncertainty about which one or what software might work in our situation.

The Criteria for Software

After all of these conflicting and confusing sources of information, time was racing by. It was now clear that we would have to find a solution with our own ingenuity and we would not be able to depend entirely upon the advise of the "so-called" experts. The first step was to locate the software around which we could build our system.

From previous experience and research, it seemed clear that any software solution would have to meet the following requirements:

1. The Software would have to have a relational data base with flexibility and expandability.

2. The system would have to have non proprietary Operating System, language, and hardware.

3. The system would have to handle both the Administrative Applications and Library Automation on one platform.

A little Providence

Providentially, a computer consultant in the field of education happened to visit the school on other business. This consultant was asked almost off handedly if he was familiar with any software systems that might handle the Seminary's needs. He just happened to have been recently hired to evaluate administrative computer systems. He was able to give the name of the system that was highest rated in his research. The problem was that the software was only available on hardware platforms that were rather expensive and somewhat out of date. And, the hardware vendor really did not have the reputation for service that instilled confidence.

Again, providentially the treasurer of the seminary received a letter from a particular vendor that announced the software mentioned above had just been ported to their hardware platform. That combination of excellent software combined with an excellent vendor seemed to provide an ideal solution to our needs.

The system we were considering was built upon the UNIX platform. The assistant librarian was assigned the task of locating any library systems that would run on this particular UNIX platform. He was able to locate just one library system that would run on this emerging platform.

At about the same time it was learned that a school similar to DTS had just completed an extensive survey of several campus administrative systems. This school had concluded that the vendor and platform that had attracted our attention was the best solution for them.

A Problem

The only real problem was that the library system was not the one that the library staff really preferred. They were also skeptical of having both the administrative and library systems on the same CPU. They had heard from other sources that this always leads to conflicts in priorities and performance problems. To some extent their concerns were valid.

The Decision

The final decision however, rested in large part upon the fact that the cost of the proposed system could be handled with the same annual expenditures as the current budget. For an initial cost of $540,000 the Seminary could have a total automation system for the campus.

Summary

The process of procuring the system had a mixture of a little wisdom, a little providence, and a little faith.

The Conversion

In order to "pull the plug" on the mainframe, it would be necessary to convert the four primary mainframe systems to the new system. I had originally assumed that we would need to run some parallel operation for up to six months. We actually turned off the mainframe in less than three months!

Timing

The system was delivered June 3, 1988. In order to minimize the dual operation it was essential that the financial modules be in operation by the beginning of the fiscal year which was less than one month away. To meet this deadline we utilized the conversion support from our vendor primarily to assist in the implementation of the accounting system. It was decided not to carry forward any of the accounting system detail into the new system. The controller determined that he could enter the previous years totals manually and that the detail would not be absolutely necessary. With excellent support from the vendor we met the target date of July 1, 1988.

The next system to be installed was the Direct Mail Fundraising system which was the most complicated. It required reproducing in function a great deal of Cobol/CICS code by using the Relational Data Base tools and converting the data from IBM VSAM into the new RDBMS. In this effort we were assisted again by the vendor as part of the overall cost of the system, and we even had one of their programmers work with us on site for two weeks. Also, one of our staff programmers wrote programs to convert the information directly from the mainframe data using magnetic tape as the transport. The complete fundraising system was converted and operational in August of 1988.

The software vendor had indicated that it was probably impossible to convert the student academic data directly and that we should plan on reentering all of the transcript and course data. The rekeying of data sounded like a nightmarish task to my staff so one of the programmers took it as a challenge and actually wrote routines to handle the conversion of the data which went smoothly. We handled Fall registration in September of 1988, exactly on schedule.

Training

The training for the current Computer Services Staff was handled with remote training by the vendor at his site.

The training of on campus users was done primarily by the computer center staff. That training was "on the job training" for the most part. For example the gift entry personnel were began using the new system on a Monday morning when we realized that there was no real reason not to proceed.

Sale of Mainframe

Since there was not much of a market for the mainframe, we considered selling "Sledge Hammer Blows" in the parking lot for frustrated computer users. The idea was to get the new vendor to pay us to do it, then get IBM to pay more for us not to do it. However, this plan was not implemented. We sold the IBM mainframe and peripherals for $2,500.

Summary

The keys to our remarkable success in converting so rapidly and smoothly were:

1. Staff Excellence. The in house staff were of excellent quality and were highly motivated to accomplish the transition to newer more useful systems.

2. Quality Vendors. All of the vendors involved performed well in their respective areas.

3. An Enthusiastic and supportive controller. Because the success of the installation would be measured in large measure by the perception of the quality of the financial modules by the controller and ultimately by the board, having the controller as a partner in this project was extremely important to the success of the venture.

The Results

The results of downsizing from the mainframe to the minicomputer have been extremely positive and quite dramatic. The campus has undergone a revolutionary transformation with the arrival of full automation.

Improved use by customers

The use of computer technology by the various departments on the campus increased dramatically. In 1985, only four departments were using computer applications on the mainframe with a user base of 33. Today, the number of users has increased to 152 users in 30 different departments. See Chart 3.

Distributed processing

The mainframe computer was primarily a "batch" oriented system but the new system puts the computer operation into the hands of the user so that he controls his own work flow including printing.

Reduced Staffing Requirements

The staff required to handle the drastically increased load has been reduced steadily over the years. In 1985-86 there were 22.5 FTE directly involved with the computer operation including Data Entry, today there are 13.25 FTE. See Charts 1, 2 and 4..

Reduced costs

Hardware and software maintenance costs have been reduced from over $112,000 to $61,000 which now includes the entire campus including the library. See Chart 4.

Reliability

The new system is easier to maintain. It never crashes as CICS did regularly.

Expandability

With flexibility and ease of use of the relational data base tools, there is a powerful ability to continually do more with less. New user defined systems are generally quite easy to create. A number of special systems for departments have been produced to handle functions that were not provided a vendor written module.

Conclusion

Our downsizing experience was a fantastic success when measured by increased service with less cost. The key components in our experience of successful downsizing were:

A Little Wisdom:

1. R&D - We did do R & D to get first hand experience with some of the technology.

2. Vendor - We did consult our vendor.

3. Consultation - We did consult a consultant.

4. Software - We did concentrate on identifying the appropriate software for our environment. We recognized that selection of software was the most important component of the decision, not hardware. The software had to be flexible, expandable, and portable.

A Little Providence

1. The Report - Someone had recently done research in this area.

2. The Alliance - The software vendor of choice had just ported to a superior platform.

A Little Faith:

1. In Staff for successful conversion.
2. In Vendor (but not blind faith)
3. In Self (Experience, you know what you know!)

Summary

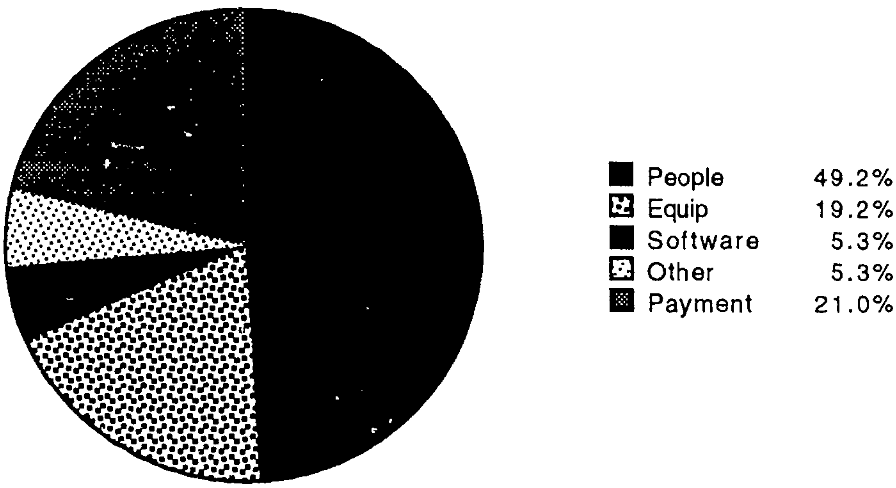
To change platforms, vendors, computer language, operating systems and trash all source code is not a fun thing to think about. Indeed, to alter the whole computer environment at one's campus is not an exercise for the faint hearted. However, with a reasonable blend of some thinking, good fortune, and faith - dramatic positive results can be achieved.

1985-86

Computer Resource Cost and Allocation

Total Computerization Costs =	$826,241	FTE = 22.5
Seminary E&G Costs=	$8,959,084	
Computer Costs =	9.2% of G&E	

Computer Cost Allocation 1985-86



Computer Resource Utilization 1985-86

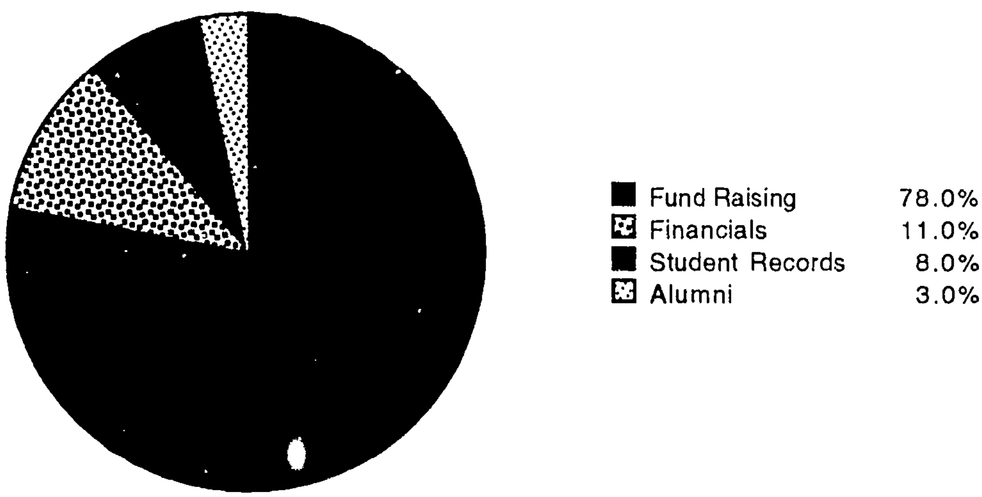


Chart 1

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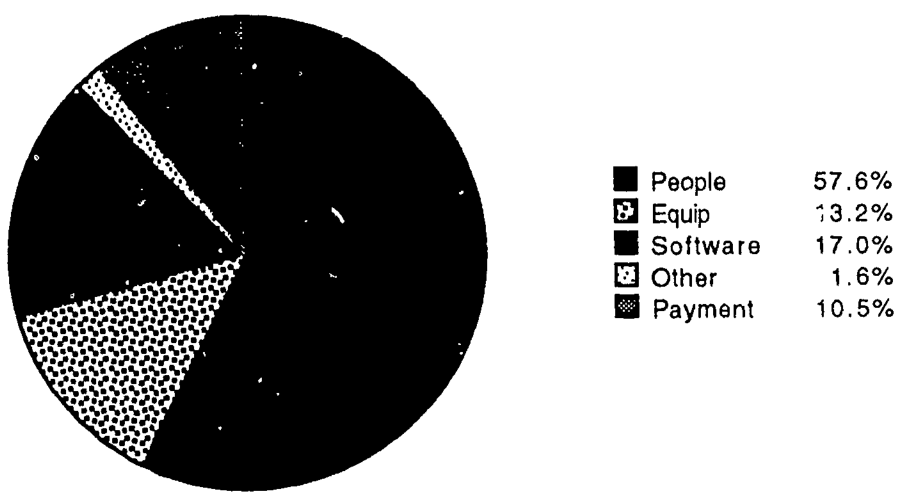
1992-93
Mini-Computer Resource Allocation

Total Computer Costs=	$701,423	FTE = 10.5
Seminary E&G Costs=	$10,374,933	
Computer Costs =	6.8% of G&E	

Computer Cost Allocation 1992-93



Computer Resource Utilization 1992-93

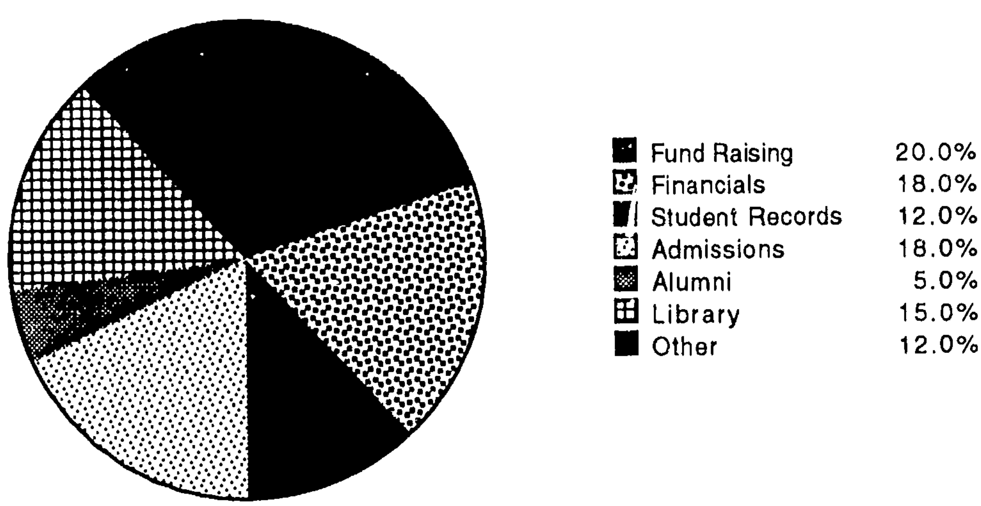
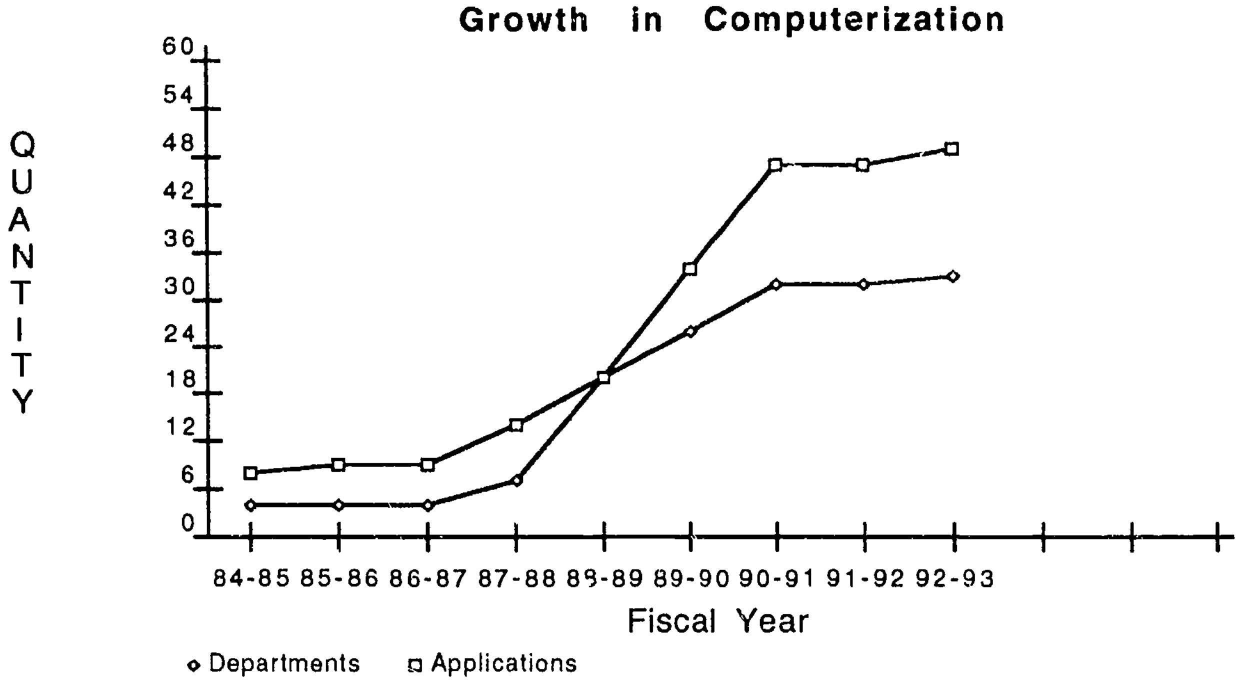


Chart 2

GROWTH IN COMPUTERIZATION AT DTS



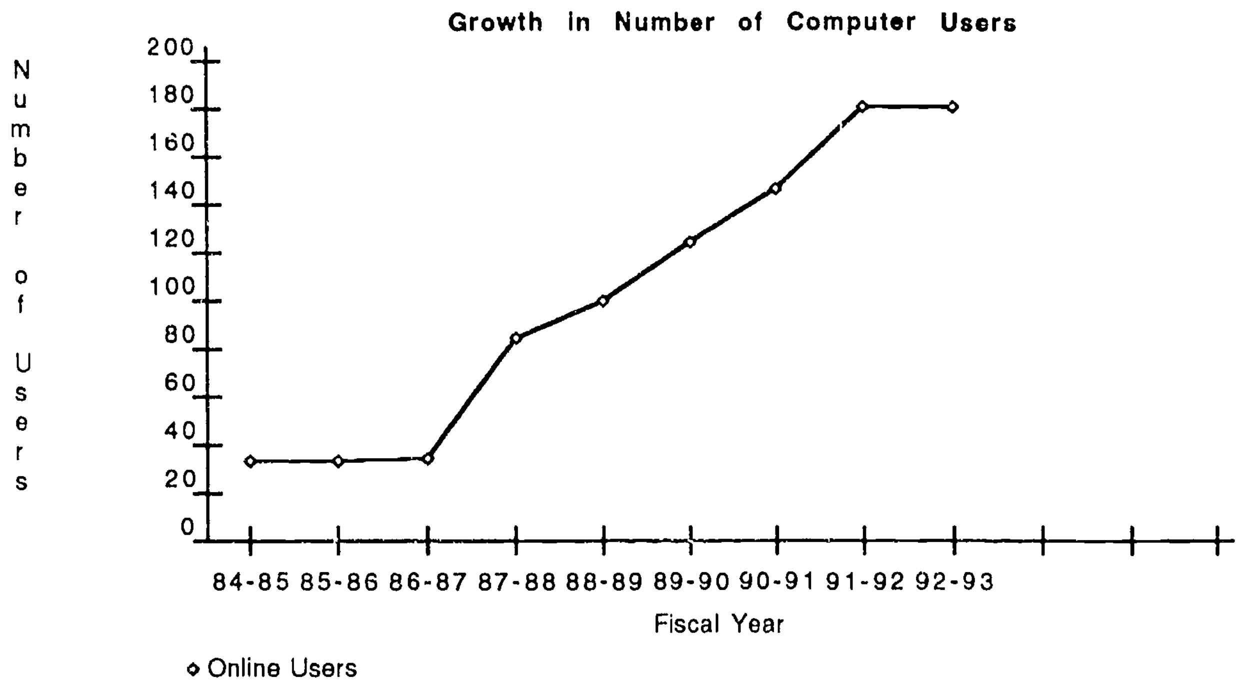
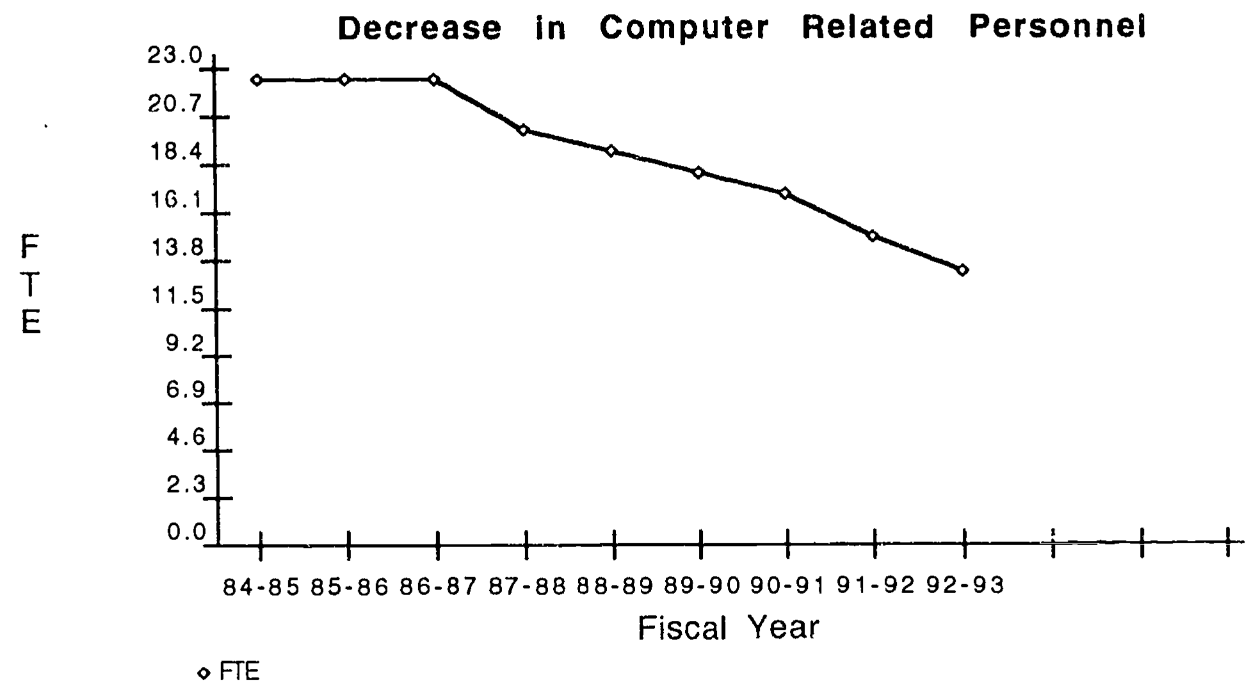


Chart 3

Decrease in Computer Personnel and Costs



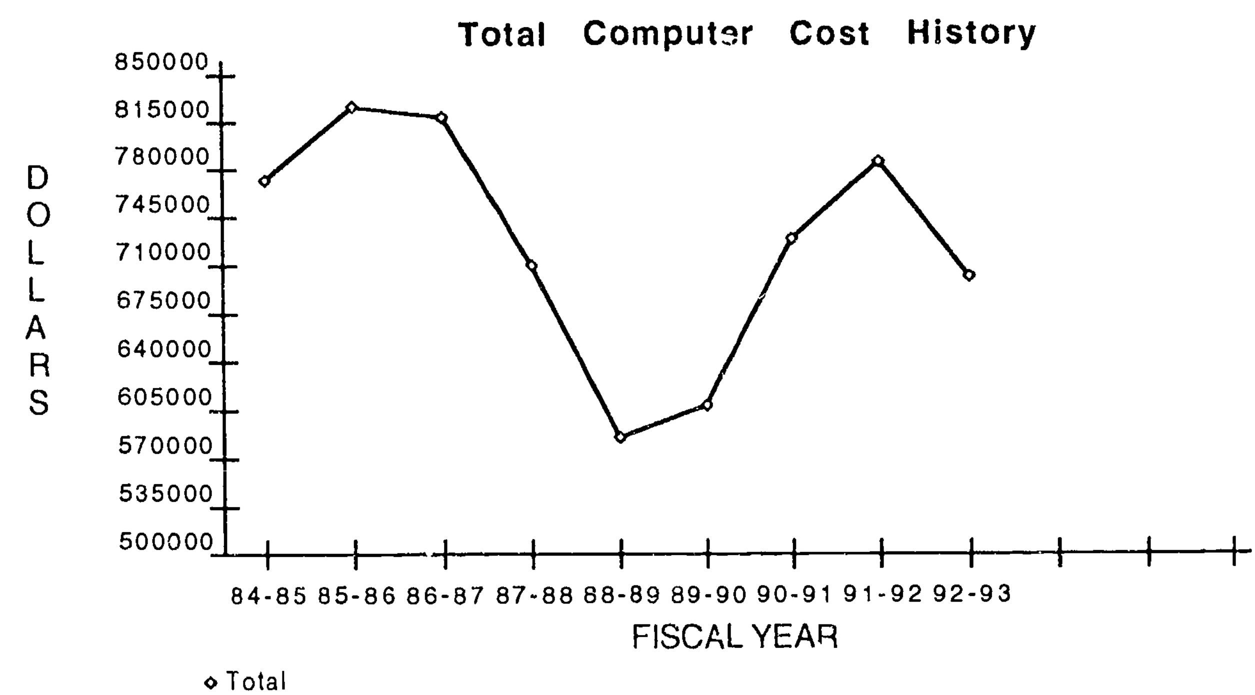


Chart 4

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INFORMATION TECHNOLOGY: The Revolution Continues

STRATEGIC PLANNING & MANAGEMENT

M2-6

Implementing Improved Methods for End User Access to Administrative Data

Michael S. Pawelczak
Rutgers—The State University of New Jersey

38th Annual
College and University
Computer Users Conference

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IMPLEMENTING IMPROVED METHODS FOR END USER ACCESS TO ADMINISTRATIVE DATA

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SAN ANTONIO, TEXAS

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IMPLEMENTING IMPROVED METHODS
FOR END USER ACCESS TO
ADMINISTRATIVE DATA

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IMPLEMENTING IMPROVED METHODS FOR

END USER ACCESS TO ADMINISTRATIVE DATA

I. INTRODUCTION

ABOUT THE UNIVERSITY

Rutgers, The State University of New Jersey, with over 47,000 students on campuses in Camden, Newark, and New Brunswick, is one of the major state university systems in the nation. The University comprises twenty-six degree-granting divisions; twelve undergraduate colleges, eleven graduate schools, and three schools offering both undergraduate and graduate degrees. Five are located in Camden, seven in Newark, and fourteen in New Brunswick.

Today; Rutgers continues to grow, both in its facilities and in the variety and depth of its educational and research programs. The University's goals for the future include the continued provision of the highest quality undergraduate and graduate education along with increased support for outstanding research to meet the needs of society and fulfill Rutgers' role as The State University of New Jersey.

IMPLEMENTING IMPROVED METHODS FOR

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ABOUT RUCS (RUTGERS UNIVERSITY COMPUTING SERVICES)

RUCS (Rutgers University Computing Services) was established in 1990 by merging the CCIS (Center For Computing and Information Systems) and the CCMS (Center for Computing and Management Systems). CCIS was primarily responsible for providing support to the academic community within the university. It supported the instructional and research functions throughout the Rutgers community. CCMS was responsible for providing support to the administrative community within the university. It was responsible for the planning, development, and maintenance of computerized systems which support administrative functions throughout the Rutgers community. This restructuring took place to reduce redundancy and allow a focus on functions.

RUCS (Rutgers University Computing Services) currently comprises seven divisions:

USER SERVICES DIVISION is the "front Door" to University computing and electronic information resources for the Rutgers community and, as such, is also the Computing Services advocate for our users, both academic and administrative. User Services is made up of the following units:

- PandA (Publications and Accounts) is responsible for the setup of accounts on all of the computers within RUCS, coordinating the publications and documentation related to these computers, publishing the RUCS Newsletter, and more.
- The Information Center is a central office staffed by RUCS personnel designed to answer user questions. For questions that cannot be answered by Information Center personnel, the user is referred to the appropriate department and/or individual to answer their question.
- The Software Consulting Unit is responsible for Supercomputing at Rutgers University, Statistical Software Packages, Machine Readable Data Files, CWIS (Campus Wide Information System), E-Mail support and training, User ad-hoc requests, data downloading, and more.
- The Microcomputer Consulting Unit assists users with PC based systems and applications. This group consults with users to determine the hardware and software best suitable to satisfy users' needs.
- The Campus Computing Facilities unit is responsible for the general and special access computer locations throughout Rutgers on the various campuses.
- The Educational Programs unit prepares and presents

courses on a wide variety of topics relevant to data processing at Rutgers University.

ADMINISTRATIVE SERVICES DIVISION is responsible for administrative computing systems which support the Rutgers community, such as student records, student services, accounting, payroll, and more. This division is divided into three departments; Educational Systems Administrative Systems, and Data Base Administration. Educational Systems include SIMS (Student Information Management Systems), Graduate Admissions, Undergraduate Admissions, Institutional Research, Student Health, Faculty Survey, Library, Scheduling and Space Management, Financial Aid, and more. Administrative Systems include Student Accounts Receivable, Payroll and Personnel Services, Accounting and Budgeting, Accounts Payable, Purchasing, and more. Data Base Administration is responsible for coordinating and maintaining the IMS data bases of both the Educational and Administrative Systems departments.

TELECOMMUNICATIONS DIVISION encompasses voice and data communications for the Newark, Camden, and New Brunswick campuses including the operation of the RUNet (the Rutgers network). This division is composed of the following departments; Network Operations, Engineering and Design, Network Services, Voice Services, Network Equipment Installation, and Network Equipment Repair.

CAMDEN COMPUTING SERVICES and NEWARK COMPUTING SERVICES DIVISIONS support their respective computing communities and are the first point of contact for their academic and administrative needs, including; microcomputing, high-performance computing, and networking.

OPERATIONS AND TECHNICAL SUPPORT DIVISION provides, maintains and operates the host computer facilities on the New Brunswick Campus which process Rutgers academic and administrative applications respectively for University departments, faculty, staff, and students. This division is made up of three departments; Administrative Systems Operations, Educational Systems Operations, and Technical Services supporting the IBM and VAX computing environments within the first two departments.

NETWORK RESEARCH/LCSR DIVISION is responsible for providing services to specific research groups including the LCSR (Laboratory for Computer Science Research), the Center for Discrete Mathematics, instructional support for the New

Brunswick Computer Science Department, and other special projects.

IMPLEMENTING IMPROVED METHODS FOR

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RUCS currently maintains a variety of computing systems from a variety of vendors to support the needs of the Rutgers community. An IBM 3081 running MVS and Super Wylbur, a cluster of DEC VAX 8650's running VMS, and a SUN Sparc Station running UNIX are available to support the academic community. An IBM ES/9000 running MVS/XA supports the administrative community with over 700 devices in 39 buildings using standard IBM technology. Numerous Apple, IBM, IBM clone microcomputer systems, and SUN workstations exist in departments throughout the University providing for specialized departmental needs.

The public network known as RUNet (Rutgers University Network) has connections to all the international networks, is used heavily by thousands of faculty, staff, and students, and is based primarily on the open non-proprietary protocol TCP/IP. Over the last few years significant growth has occurred in RUNet through the commitment of University resources to permit construction of a fiber-optic backbone cable plant on several Rutgers campuses, resulting in the direct interconnection of sixty (60) buildings. In addition, over two hundred (200) dial-in ports are available into RUNet. RUNet currently links thousands of computers through the interconnection of one hundred and twelve (112) TCP/IP subnets, twenty-one (21) DECnet regions, nineteen (19) Novell local area networks, and ninety-seven (97) Appletalk zones, all of which provide services to academic and potential administrative systems end users. In addition to the networks now linked by RUNet, there are twenty-one (21) isolated Novell networks awaiting connections to RUNet.

RUCS continues to improve and build upon the numerous services offered. We are dedicated to strengthening the level of support for faculty, students, administrators, and staff as they use computing and electronic information resources.

IMPLEMENTING IMPROVED METHODS FOR

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II. BACKGROUND

(How we got where we are today - a historical perspective)

ABOUT OUR USERS

As the number of faculty, students, and staff accessing the University's systems grew, it became evident that there were different types of users, especially in the administrative computing area. These types of users have been loosely categorized as:

CLIENTS - Clients are the people for whom particular application systems have been developed. They are the prime users and/or custodians of, and are responsible for, the data contained within these systems. For example, the Office of the Registrar is a client and the Student Registration System is the application used by this office. Client staff are intimately familiar with their systems and work closely with their assigned project teams from the Administrative Services Division of Computing Services to enhance, modify, and document these systems.

END USERS - End Users are people who have a need to work with the information contained within certain application systems. End Users may or may not be intimately familiar with the application systems they need to access. For example, a department chair desiring class roster information from the Student Registration System is an End User. In the End User areas, there were a variety of procedures in place to access and process information, such as:

- direct access to the mainframe system and its applications via hard-wired connections,
- access to the mainframe system and its applications via RUNet,
- dial-up access to the mainframe system and its applications,
- departmental "Shadow" systems where the departments in question effectively process their own data a second time, and
- an ad-hoc request procedure for special reporting and/or processing requests.

Typically, End User requests were received for reports and/or functions that were not currently available within existing application functions. These requests would be channeled to the project teams responsible for the particular application to be

fulfilled. Frequently, the request could be handled via Mark IV, a product from Sterling Software designed for quick report generation. When this was not possible, a third generation language program (COBOL) had to be developed. Depending on the workload of the project team and the complexity of the task, turn around time from request to delivery of the final report or function ranged from a few days to a few weeks to even longer. The same scenario also held true for Data Download requests. This situation presented an extraordinary opportunity for improvement.

ABOUT USER NEEDS

With thousands of users in these areas, learning user needs and communicating activities and upcoming events became of paramount importance. Clients and End Users were actively solicited to take part in RUCS' efforts to improve services. In 1990, RUCS initiated a University-wide study to determine how we were perceived and how we might best improve service to this community. The study queried Clients and End Users throughout the University. One specific area that stood out in the majority of the responses was IMPROVED ACCESS TO ADMINISTRATIVE DATA. Many respondents expressed a desire to access and/or download data currently collected and stored in the Administrative Systems Division's mainframe computer in a timely manner. Data downloading capability was viewed as a way to reduce the potential for data entry errors when data was entered a "second" time into departmental systems. The data desired included: Student, Payroll, Accounting, Budgetary information, and more. Providing a USER FRIENDLY means of access was another point frequently mentioned.

THE SEARCH FOR A SOLUTION

In response to this survey, RUCS formed an on-going committee to study ways to improve access to administrative data. This Distributed Data Base Committee enlisted the aid of many areas in the University community at large to determine the best approach to accessing and downloading Administrative Data.

One issue of concern to all involved was security. In a separate study, the RUCS Security Review Committee reviewed network history, the administrative computing environment, and possible network security risks. This committee then recommended new technology in the form of non-reusable password technology for users accessing administrative data from any segment of the network (RUNet). This technology involves mainframe software on the host and the purchase of a device similar to a credit-card by network

users. This device displays a non-repeating number that is coordinated with the user's account on the mainframe. In addition to this new technology, the committee recommended new procedures to complement this technology. New sign-on screens and procedures were developed.

The Distributed Data Base Committee recommended a two-phased approach for improving data access for End Users. The first phase would be to improve the selection of administrative data and the eventual downloading of that data to the End User workstation. The second phase will require the addition of distributed database software both for the mainframe (server) and personal computer or workstation (client). This paper will deal with events related to Phase I.

The Distributed Data Base Committee created a Task Force which completed a preliminary evaluation of products designed specifically for downloading mainframe data to personal computers. The Task Force selected five (5) products for further review. Vendors of these products were contacted and a series of in-house demonstrations were arranged. Clients and End Users were active participants in these demonstrations. The Distributed Data Base Committee compiled detailed evaluations of these products culminating with the recommendation to purchase Answer/DB and Micro Answer II from Sterling Software.

THE CHOSEN SOLUTION

Answer/DB and Micro Answer II are companion products. Answer/DB runs on the mainframe computer and is used to generate ad-hoc queries and reports. This product offers the End User a simplified lead-through style of operation based on the information that the End User is permitted to see. Conceptually it is very similar to the Mark IV product already installed except that Answer/DB is completely MENU DRIVEN and USER FRIENDLY. Requests submitted by Answer/DB are stored in a holding file for subsequent processing by an Extractor/Processor. These Extractor/Processors are run daily at scheduled intervals. As the Extractor/Processors run, they process all currently outstanding queries and produce output that is placed back into the same holding file as the original request. This output is now available for review and/or printing by the requesting user the next time they access the system.

Micro Answer II runs on an IBM PC or any clone. It is designed to be a "front end" for the Answer/DB product.

IMPLEMENTING IMPROVED METHODS FOR

END USER ACCESS TO ADMINISTRATIVE DATA

Information concerning data areas that can be accessed by a particular user is first downloaded to the PC from the mainframe. Once this query and data access permission information has been downloaded to the PC, the user can create queries for submission while working off-line on their PC. These queries can be submitted for subsequent viewing and/or downloading. Like Answer/DB, Micro Answer II is MENU DRIVEN and USER FRIENDLY. Once queries have been created, the user can sign on to the mainframe to upload their query into the same holding file used for Answer/DB requests. The Extractor/Processors then handle the Micro Answer II requests in the same manner as they handle Answer/DB requests; placing completed requests back into the holding file. Once completed, Micro Answer II allows the user to download the retrieved data to the PC. Once the data has been retrieved to the PC, it can be converted to one or several formats. There formats include; ASCII, Lotus 1-2-3, Lotus Symphony, dBASE, DIF, and more.

IMPLEMENTING IMPROVED METHODS FOR END USER ACCESS TO ADMINISTRATIVE DATA

III. IMPLEMENTATION

STAFFING

Due to several retirements within RUCS, it was possible to realign personnel lines so that an application project team of three people could be created within the Software Consulting Unit of the User Services Division. The team consisted of two Programmer Analysts led by one Senior Programmer Analyst. All three of these positions were filled by new hires. One Programmer Analyst came from within the University while the other two positions were filled from outside the University. With staffing levels completed, the new team (which came to be known as THE "A" TEAM) underwent vendor training to become on-site coordinators of the products. Additional responsibilities of the "A" Team include; developing and teaching courses on E-Mail, JCL, and other topics as necessary; fulfilling End User ad-hoc requests; developing documentation on applicable software products and procedures for PandA; and more.

PROJECT OVERSIGHT

The Distributed Data Base Committee formed two sub-committees to oversee the implementation of the product. A Distributed Data Steering Committee was charged with identification of issues relating to the larger University community, communications with the University community, and oversight of the implementation. This committee was composed of representatives from various disciplines and departments within the University. The Distributed Data Steering Committee prepared an announcement of the decision to purchase the product to facilitate data access and asked for volunteers to become Pilot Users of the new product.

The Distributed Data Steering Committee identified several tasks it deemed important for the success of the implementation. First was the issue of managing user expectations. Early on, we realized that the success of this project relied heavily on how users perceived this new service. The Steering Committee decided to pursue a marketing strategy when describing the new methods to end users. Relative comparisons were made between the current lead times for fulfilling End User requests for new reports and the anticipated lead times via the new method. This aspect was important because while the new method entailed lead times of several hours, the old lead times were often days and sometimes weeks.

IMPLEMENTING IMPROVED METHODS FOR

END USER ACCESS TO ADMINISTRATIVE DATA

A Distributed Data Implementation Committee was charged with the actual product implementation. This committee received guidance from the Distributed Data Steering Committee. This Distributed Data Implementation Committee was composed of representatives of the various divisions within RUCS that were responsible for the operation and processing of the Administrative Systems.

The Distributed Data Steering Committee suggested a phased approach for the Distributed Data Implementation Committee to follow. This approach consisted of three phases. Phase I was to involve the use of three (3) pilot users, Phase II was to encompass ten (10) pilot users, and Phase III would provide general availability of the product to the University community. With guidance from the Distributed Data Implementation Committee, the "A" Team was given responsibility for the initial implementation of the pilots and for the general release or "roll out" of the product.

Following a classic Project Team Approach, the "A" Team set about implementing two internal pilots and one external pilot. The team's ability to focus on the task at hand and provide a central organization to act as a clearing house for all aspects of the implementation was an advantage. Periodic status updates to the Distributed Data Base Implementation Committee helped keep the project team aware of the concerns and issues of all of the operational areas involved. The first task for the "A" Team was to develop a list of tasks required for the implementation of all three phases and to put that task list into a logical project plan complete with time estimates for completion. The team made judicious use of a PC based project tracking software package to build the Project Plan, track its progress and report that progress to the committees on a periodic basis. The second task for the "A" Team was to develop a set of standards to be used during the implementation. These standards dealt with naming conventions, rules for creating security access profiles, formats for the on-line "help" texts associated with each data field accessed, and more.

Once the project standards had been set, work could begin. Major activities within the project plan included the following:

- meeting with potential pilots to review their requirements and identify their needs,
- selecting pilots based on their needs,
- building data definitions for the data to be accessed,
- testing the data definitions in actual use with the

product,

- building help descriptions for each data field within each data definition,
- testing the implementation of the help descriptions,
- establishing automated procedures for uploading the help descriptions to the data definitions,
- building individual profiles for users of the system,
- establishing automated procedures for uploading the profiles from a master file so that security could be easily maintained,
- conducting on-site installation and training for the initial products in the use of the product, and
- more...

As the "A" Team progressed, other operational areas were gradually involved. This method allowed the "A" Team to lay the groundwork for the implementation and bring other technical areas into the loop prior to any production release.

The "A" Team initially completed three (3) pilots in a test mode. This concluded Phase I as previously identified. Two of these pilots were internal to RUCS and the third was an outside user. The second phase of pilots consisted of seven (7) outside users from various areas within the University. These pilots were selected from those that had volunteered in response to the announcement from the Distributed Data Base Steering Committee and were phased in based on the specific areas of information that they required.

The "A" Team chose to build the data definitions for the most widely used data bases first. Pilots were then added based on their requirements to access this data. As more pilots were selected, more data bases were defined to meet their needs. With the completion of the individual data definitions for the most widely used data bases, it was then possible to build definitions for LOGICAL DATA VIEWS that combined data from two or more areas that could be presented singularly to the users. It became an evolving process with the managed addition of pilots and data definitions to foster a smooth implementation. This technique enabled the "A" Team to build data definitions in an organized manner that provided maximum response to "end user" needs. Concurrently with the building of the data definitions, the "A" Team was also working closely with the Security Office to build proper user profiles that would protect the confidentiality of the data while allowing the access to information that the users were entitled to.

IMPLEMENTING IMPROVED METHODS FOR

END USER ACCESS TO ADMINISTRATIVE DATA

As Phase I was being completed, the team was also developing formal installation materials, documentation, training materials and courses. These items were developed with input from the pilots and in conjunction with the appropriate areas within the User Services Division of RUCS, particularly PandA and the Educational Programs Unit.

As with any major project of this magnitude, we were not without our share of problems. However, the vendor, Sterling Software, was ever ready, willing, and able to assist us. Their 800 help line was invaluable. In addition, the supporting groups within RUCS Operations and Technical Support and RUCS Administrative Services were instrumental in easing the new products into the every day world within Rutgers.

WHERE WE ARE TODAY

Today, we have successfully created data definitions for all of the critical Data Bases in use at Rutgers. In addition, we have created definitions for several of the lesser used areas. RUCS has developed training sessions to teach the use of Answer/DB and Micro Answer II and we have many users actively querying and downloading data daily. This project has become an EVOLVING PROCESS that is opening more and more areas to user access every day.

IMPLEMENTING IMPROVED METHODS FOR

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IV. THE FUTURE

WHERE WE'RE GOING FROM HERE

The search continues for an enterprise solution that will take us to a truly distributed processing environment with owners of data directly responsible for its entry and content.

RUCS will continue to work with the University Community to develop and prepare a long-term data base strategy for the University which a successor group will implement, taking into account the virtues of relational and client/server architectures, distributed computing, workstation capacities, and vendor and market developments.

RUCS will use investigative and decision-making processes to inform the University community about data base technologies and potentials, and to develop RUCS staff skills and knowledge.

RUCS will involve appropriate users and user groups in the investigations and recommendations. Provosts and vice presidents will be asked to suggest appropriate audiences and participants.

RUCS will promote the need for ancillary policies which need to be developed by other appropriate University bodies, e.g. an administrative information access policy, and an information security policy. WE'LL NEED A WELL DEFINED ACCESS POLICY. We'll need a policy stating disclaimers associated with all data provided by various areas. This is especially true in the case where one area receives data from another and then embellishes it to provide more detailed information. "End Users" of this second generation data have the right to know its age and original source as well as any subsequent additions, updates, and/or special circumstances that may apply.

IMPLEMENTING IMPROVED METHODS FOR

END USER ACCESS TO ADMINISTRATIVE DATA

V. CONCLUSION

While there is much to be done to complete the long range plan to provide greater access to administrative data to End Users, much has been successfully accomplished. If there is one overriding reason for this success, it has been the INVOLVEMENT and COOPERATION of the Clients and End Users throughout the life of this project. Kudos to our users and for the efforts they have put forth to make this a successful project. Our users are our customers, and OUR CUSTOMERS ARE FIRST RATE.

IMPLEMENTING IMPROVED METHODS FOR

END USER ACCESS TO ADMINISTRATIVE DATA

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INFORMATION TECHNOLOGY: The Revolution Continues

STRATEGIC PLANNING & MANAGEMENT

M3-6

Structured Analysis Using Event Response Technique

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38th Annual
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Structured Analysis
Using
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This presentation will show how The Ohio State University used McMenamin & Palmer's Event/Response technique as an alternative to functional decomposition to extract essential requirements for a system. University Systems at The Ohio State University is responsible for administrative computing for the entire University community. Therefore we did not develop our process as a research project; rather our reasons were very practical. Our accomplishment demonstrates what can be achieved with sincere management support and pro-active people working toward a similar goal with very limited resources. Because of the personal dedication and determination of the people involved, we now have a process we not only feel comfortable with, but we also feel is a very practical solution.

The technique begins with defining the scope of the project with the customer (client) i.e., creating a context diagram. This diagram identifies the events that "bring the system to life" and the response by the system to these triggers. For each event the analysts, along with the customer, create high-level data flow diagrams (one bubble per event), a mini specification, and an entity relationship diagram. Throughout the presentation we discuss the applicability of an integrated CASE tool to record and manage all analysis results. We end the presentation with a brief discussion of our transition strategy between structured analysis and structured design.

As all good IS shops we were looking for the "perfect" initial project with which to try our wings and concurrently develop an Information Engineering methodology. What was presented to us was a project that was just about perfect - almost autonomous (very little interface with other systems) and critical enough to present a sense of urgency to get it completed and installed. The proposed new system, to accommodate the Graduate and Family Housing office of the University, had been in the works for some time. The analyst assigned to the project was searching for an alternative to traditional methods to develop this project and presented the challenge to our Software Process and Information Engineering group.

Having done considerable research and self-study into structured techniques, the group formed an analysis team and set out to "do analysis." Having been trained in classic DeMarco structured analysis we fully intended to do functional decomposition. We discovered very quickly that we were not at all comfortable with the main functions we were able to identify. Having NOT done an Information Strategy Plan (ISP) for this office led us to groping for major functions around which to place our events. Obviously a different approach was needed.

A decision was made to involve our customer in facilitated sessions to tap their knowledge and hopefully raise our comfort level as well as shorten the cycle for analysis. Event / Response modeling proved to be very useful for this purpose. It is our opinion, having launched the second project, that if the system in question contains very little process and large amounts of data, Event/Response is probably not the best method for analysis.

When performing structured analysis using the Event/Response technique, you will find there are two very definite methodology steps to be taken. The first is to define the scope of the project. With the help of the customer develop the context diagram. From this diagram determine the essential events that drive the system. During this process make sure that the output as well as the input is analyzed. Often there is output that cannot be directly associated with an input "trigger." This output is usually generated by some passage of time (like preparing monthly statements), and are generated by what are called "temporal" events. Nevertheless they need to be included in the event list. By looking closely at this kind of event it is often simple to combine several similar output reports into a single outflow such as "Monthly Reports." With careful definition of the scope of the project, it becomes much easier to determine whether a topic brought up for discussion is really a part of the project or not.

Once the project scope is firmly established, the second methodology step can be taken. That step is to very diligently capture the business policy of the customer in language that they can understand. We found the best method for doing this was to continue the intensive meetings with our customer. As a team, and in this part of the process we considered the customers as part of the team, we were able to stay on task very well. Any item brought to the table first had to pass the test of being within the scope of the project. If it was indeed a necessary item, it was included in the event list and added to the project.

In order to capture the business policy effectively, we created our Event/Response models at this point in the process. The team discovered a lot of time and effort could be saved by following a simple rule of decomposition. Each event defined from the context diagram would contain only one bubble. If more than one bubble seemed to be indicated we first looked to see if perhaps we had more than one event to define. If the team decided there was only one event, but more than one bubble seemed to be needed, the consensus was we were trying to decompose too far for this point in the project life cycle. Being from a programming background, the team was often not comfortable with the level of abstraction this rule forced upon us, but at the end of analysis we were glad we stuck to our guns.

Another discovery that our analysis team made was the value of outside help. The going got much easier when we contracted for consultant help at various stages of this process. The consultant we chose was Bill Barbour of Bayswater Associates. We did not contract with him to do the work, but to "look over our shoulder" occasionally and advise us on our progress. This proved *invaluable* as a method of shortening the learning curve. While the cost of consultant help may look very expensive on the surface, it is worth it's weight in gold to the development of a methodology that will work in your environment.

As the models are developed, it is very helpful to have access to a fully integrated CASE tool to capture your analysis as you go. We use the KnowledgeWare set of tools, but any fully integrated CASE tool will serve your purposes very nicely. After the data flow diagrams were developed, precise definitions of each and every data flow were developed. This definition helped to normalize and stabilize the data model. The CASE tool was fully utilized at this point

to capture definitions for data items as well as allowable values (if known) for further use by the design team. Liberal use of comments were made. Careful attention to just what data are present and which data are actually required can help shed light on future uses of data. One of the benefits of these intense customer sessions was to facilitate Business Process Redefinition as we went through the process. Having discussions about possible future uses for data helped in the modeling process. In addition this information will be valuable at the design stage as a guide to development of the current system as well as keeping an eye on the future.

With the completion of the data flow diagram and data flow definition for each event, the mini-specs are then developed. Careful attention must be given in this step to dealing with "what" the system is trying to accomplish, not "how" it is to be done. This is very difficult to do and takes a lot of practice. If too much attention is paid to the form (structured English) and not enough to content (what are we defining ?) the result will look very much like pseudo code. The mini-spec. is a good place to store things such as formulas, rates, or design notes. While these items are definitely part of the "how", the emphasis in the thought process must stay tuned to the "what" of the system. As a general rule of thumb our team discovered that any mini-spec. much over a page and a half would contain too much "how".

Just a mention here about time constraints. We've all been through the scenario on system development projects where analysis was done because it was a checklist item on the project plan. If analysis was slated for two months and two months are up then "analysis is done - let's get on with design". In order to cut the cycle and help make cultural change happen, the team must be conscious of time. Time boxes need to be established, probably one for each event, and consensus reached within that time. If some item is holding up progress, leave it and push on. This entire process is iterative. When you have something done (notice we didn't say perfect) it should be shared. This "first cut" approach works well to keep things moving. Try to gain consensus within three iterations. If this is not happening, chances are you are delving into too much detail. Learning to think at this level of abstraction is not easy. It takes a lot of faith that the process will work. For us it worked well.

Along with the mini-specs and data flow diagrams Information Engineering also requires a fully attributed and normalized data model. You may find developing these diagrams a work effort done without the customer. Of all the "new" requirements definitions our team worked on, the customer found it hardest to understand an entity relationship diagram. A fully attributed and normalized data model, however, is the cornerstone of the design step in the Information Engineering discipline. Careful attention to producing this work product will pay big dividends down the road. Your CASE tool is a big help here if it is fully integrated. It is much easier to create an "entity view" for each event, than to try and keep up with the entire entity model for the project. An Integrated CASE tool will automatically create the overall entity model from each event's entity view. The CASE tool's relational translator will take the entity model and produce a "first cut" data base schema. Please notice this is done from the data model, not the mini-specs or any part of the process model.

When the above steps are complete for each event and consensus has been reached, it's time to pause for a moment and reflect on the process you just went through. If the customer has been with you every step of the way then you will have joint ownership of the system from this point on. The customer can say, with some pride, that the system about to be developed is *their* system. This will help solve customer involvement issues further on in the process, most notably at prototyping and test time.

What are the advantages of Event/Response modeling ? The diagrams and techniques used appear to be more intuitive to the customer. They don't have the feeling that the process is as mysterious as they perceived it to be. Working with pictures as well as words made the process go much faster. With our initial project traditional analysis would have been estimated to take between six and nine months to complete. Information Engineering estimation said it should take four months. While it took longer than four calendar months, we were quite happy with the result. We measured how much time we spent in methodology development (in hours) based on working through the analysis versus total hours spent on the project. By taking away the methodology hours we discovered the estimate of four months was very close, even though this was an initial project.

Another advantage of the process is the ability to do Business Process Redefinition as we went along. This introduced good ideas up front while they were still fresh in everyone's mind. Any idea was explored for feasibility. If it was able to be accommodated easily, we added it to the analysis. If we did not choose to include it, at the very least it was documented for future enhancement. By enforcing the rigor of Information Engineering , the models we create are ready if we decide at some time in the future to transition to Object Oriented design and construction.

We used the KnowledgeWare CASE tool set to do several things. We used the Data Flow Diagrammer module to represent Event/Response models. We used the Entity Relationship Diagrammer module to represent object partitioning. The Minispec Action Diagrammer was used to represent process models. In addition our team used the DOC Workstation to create a comprehensive analysis document for use by the design team. Included were all of the diagrams, the data definitions, the mini specs and other information from text files deemed useful for the design step.

The final subject to be addressed in this presentation will be the transition from analysis to design. There are many schools of thought on how to manage this phase. Since agreement could not be reached, we created our own method in consort with our consultant. The deliverables from this process are as follows:

1. Create Entity/Process (CRUD) Matrix
2. Walk-through with Design Team
3. Create first-cut data base schema with Relational Translator
4. Create activity list from mini specs and identify processors
5. Create transitional Data Flow Diagram from activities
6. Identify Central Transform
7. Create first-cut Structure Charts

Creation of the CRUD matrix as a last step in the analysis process will verify the essential activities. We were able to make sure that each entity was created, updated, deleted and read by at least one activity (event). If you notice an activity which only reads lots of data without producing anything (not even a report), it is a good bet that it is not a necessary activity.

Walking through the analysis document with the design team is a very good verification tool. By addressing the questions and comments of the designers any lingering "holes" in the analysis should be uncovered. When the design team begins to prototype for screen formats

and report layouts, they may uncover some subtle changes that need to be made to the analysis model. But as a rule the major oversights will be uncovered during the walk-through process.

The next step is to use the CASE tool to process the entity model through a relational translator and create a first-cut data base schema. These tools are very good at highlighting missing candidate keys to help the team create unique instances of each entity and/or relationship. Doing this process manually would take enormous amounts of time and would always be suspect of having "missed something".

Creating a list of activities from each mini-spec begins the process of design decomposition. In this process the processors are identified also. Here is where the first determinations are made, activity by activity, whether the processor of the activity will be a person or the system -- or the drawing of the classic "man machine boundary". No attempt is made here to sequence events -- just create the list. This process will begin to identify things such as input verification (edits), volume and frequency counts, and perhaps some process redefinition for the manual processes which take place in support of the computer system. It is important to remember that this in no way implies changing manual methods to accommodate a proposed computer system, but rather a smooth incorporation of both machine and manual processes.

Once the activity list is created from the mini-spec the team can create a transitional data flow diagram from it. Previously we addressed the problem of taking decomposition to a level too rich in detail. Here is the place for such decomposition. At this point the team is very much aware, as is the customer, of many subtle conditions and business policies which led to the creation of the activity list. At this point it now makes sense to decompose our event bubble to picture the *activities* in a data flow diagram.. Experience has taught us that enormous amounts of time and energy can be saved by postponing decomposition until this point. Our models will typically contain only three or four levels of decomposition even after we have done this transitional data flow diagram. Looking over our experience we feel safe in saying that making the mental shift from infinite detail (traditional) to the abstract (structured) was the most difficult task in the entire process. We were used to thinking analytically at a level of detail that properly belongs on the structure chart in the design process.

As the transitional data flow diagram is produced, be giving some thought as to which activity is the central transform activity. This activity will be the prime candidate for the control module in the structure chart for the process under study.

Finally the first-cut structure chart will be created. We call it first-cut for a reason. Like the analysis, this will be the first working document in the design process. It is intended to be a starting point for proper definition of code modules to be identified in the design process. As prototyping begins and implementation issues begin to be dealt with the structure chart will be refined to the point where coding assignments may be made at the transition from design to construction.

Having emphasized the role of the team throughout this presentation, let us take the opportunity to make the point one more time. The entire process of Event/Response Modeling cannot take place in a vacuum. The dedication and involvement of all team members is critical. Working together brings out a synergy that facilitates the process both in duration and, more importantly, the quality of the product produced. As you proceed in *your* transition from the traditional systems development methodology to Information Engineering you will face many

and varied trials and tribulations. The cultural change that is required by itself is large. The good news is that as you reach each milestone along the way you will feel a sense of accomplishment - a sense that the entire process is worthwhile.

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STRATEGIC PLANNING & MANAGEMENT

M4-6

Horror Followed by Heroics: Recovery from Hurricane Andrew

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Horror Followed by Heroics: Recovery from Hurricane Andrew

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Not only did Hurricane Andrew provide us with some valuable disaster recovery lessons, but the experience provided all of the citizens of South Florida with some emotional lessons as well. This paper outlines some of the lessons and experiences from the perspectives of both Miami-Dade Community College and the University of Miami.

> *"No single thing could have done more to restore the confidence of the people than the fact they got their paychecks on time."*
>
> Dr. Carl Eisdorfer
> Chairman, Department of Psychiatry
> University of Miami

The University of Miami Perspective

Hurricane Andrew arrived on August 24 with winds up to 175 mph. At the University of Miami, for example, 35 roofs, 800 windows and 3000 trees were damaged, broken or destroyed. Over 400 employees lost their homes and over 5000 reported claims in excess of $5,000. Almost 5000 parents and students were on campus for orientation day and the opening of the residential colleges for the Fall semester. They rode out the storm huddled on the floors in hallways.

Immediately after Andrew calmed down, the recovery began. The University of Miami's Public Safety Director went to the President's house and, "crashing through the woods," brought him to campus. The people in the telecommunications building computing center, residential colleges and other shelters on campus, like groundhogs, slowly came out and saw the campus in shadow. Roads were impassable and with little power or phone service in the county, food and supplies were threatened. The

health of the people on campus would become a growing concern as facilities became overburdened.

Communications on campus never faltered except the buttons on the phones did not light nor did the ringers ring. Mobile phones were clogged, regular service was spotty, and blue jeans and sneakers were joined by beepers as the dress code.

Because there are additional concerns for the employees of the institution as well as the student population at a residential college/university, both institutions learned first hand about the human side of disaster and recovery planning and implementation. As an example listed below are some of the things the University of Miami did:

1. Daily meetings were held by the President with administration, faculty, and staff to exchange information and make decisions.

2. A census of the University employees was begun. Within a week, all but 400 were accounted for. After search parties were sent out, everyone was accounted for.

3. School was delayed for 18 days.

4. Students were offered the opportunity to go back home and be reimbursed with credit to their Spring tuition.

5. Employees were told to stay off campus until August 31, to allow time for clean-up and repair. (350 stayed)

6. A volunteer clearing house was established and 300 students worked side by side with University employees.

7. A program named UM Cares About Neighbors (UM-CAN) was begun to get relief to UM employees. Foodstuffs and money were collected to help less fortunate employees.

8. The student health center was opened 24 hours a day with a doctor and a nurse always available.

9. Facilities Management began cleaning up the campus. Contractors from Palm

Beach, commercial grinders from Georgia, and tree-trimmers with chain saws from 4 states worked from dawn to dusk.

10. Water trucks and 35 portable toilets were placed in the residential complex.

11. Physical Plant crews went out with plywood, roofing materials and generators to secure the homes of University employees all over the county.

12. Over 200 Florida Power & Light employees from out-of-county were housed at the recreation center while they worked to restore electricity in South Dade.

13. While telephones never went down at the campus, a communications link to the Virginia Key campus was destroyed. Part of the backbone on campus was broken by an uplifted tree whose roots had grown under the cable.

14. The computer system, totally backed-up, could not come on-line because it was water-cooled and the water pressure on the campus was too low. After intense efforts for two days, the system was up and running normally. Payroll, including direct deposit, was available on time.

15. Housing for faculty and staff who lost their houses was arranged by the individual and the University. Apartments 20 miles from campus were leased by the University for those in need.

16. The Purchasing Office was available so the University could buy everything it needed -- from water to portable toilets to rebuilding supplies to hotel space.

17. Police officers worked 12 hour shifts to secure the campus. They were supplemented with officers from other universities.

As a whole, the University suffered up to $15 million damage, of which half is covered by insurance. FEMA has been asked to cover most of the remaining portion. The University is looking at a $1 - 4 million problem during the 1992-93 academic year, not including lost revenue. But, although a tremendous hardship, recovery will occur. "I was so proud of our associates," said President Foote. "They just did a super job under the most difficult of conditions and with real bravery. Hemingway said 'courage is grace under pressure' and it's difficult to imagine more

pressure than this place was under. There couldn't be more courage in so many wonderful people than I saw displayed at this University."

Insights from Miami-Dade Community College

Andrew, the greatest natural disaster in US history, provides an interesting case study for disaster planning and recovery. Although it is difficult to interpolate this experience, at Miami-Dade Community College several conclusions were reached.

1. A Disaster Plan is imperative, if only to provide a set of rules to go by so that preparation for an impending disaster can take place in an orderly fashion.

2. Information Technology areas are far better prepared to deal with preparation and aftermath than the rest of the organization. There can be some misunderstandings and tension as a result.

3. Most organizations do not understand the nature of their vulnerability to technology disruption, especially if high standards of service are the norm.

4. Rehearsal and practice, as well as follow-up, need to be a matter of rigor and routine.

5. Communications during and after the disaster can be a very distinct problem.

With the planned support of Dade County Public Schools, the M-DCC payrolls were processed on August 27, 3 days after the storm. Due to tenacious people who used creative ways of navigating through the devastated areas, the checks were distributed to College employees on time. With additional support from vendors, the computer systems were brought back up on September 3. On September 8, the College opened for business as usual, and on September 14, classes started for the Fall Term, two weeks later than scheduled.

As someone has said, Andrew was in a different category than most disasters that occupy the media. For people directly affected, it was more like a warfare disaster than a storm. The disaster area encompassed 300 square miles of area, caused as much as $30 billion of damage, and placed 450,000 residents in home and business crisis. Two campuses of Miami-Dade Community College were seriously affected. The Homestead Campus had portable classrooms destroyed; the Kendall Campus had one building (which was used as an evacuation shelter) seriously damaged. That

campus was used as a shelter site, a food and water distribution site, and a bivouac site for Army and National Guard troops.

Is it any wonder that under these awesome conditions, the psychological effects of a disaster of this magnitude lasts for months? It should be noted that when planning for a disaster, people's emotional states should be taken into account. Every member of the disaster recovery team will very possibly be a victim of that disaster. The trauma of a disaster like Hurricane Andrew throws people so far out of their range of equilibrium that it is difficult for them to restore a sense of balance in life. The trauma is caused by all of the loss experienced by the victims.

- Loss of control over one's life
- Loss of faith in one's God or other people
- Loss of loved ones or personally-significant property
- Loss of a sense of immortality and invulnerability
- Loss of future

This tremendous sense of loss experienced by the victims in the disaster area causes people to experience a range of emotional reactions:

Stage 1: Shock, disbelief, denial

Stage 2: Anger, fear, grief, frustration, guilt

Stage 3: Acceptance, reconstruction of equilibrium

Because these emotional reactions are experienced by the majority of people living in the affected area, work productivity has been affected. Additionally, the stress reactions which manifest themselves in the victims should most probably be dealt with specifically and professionally. At Miami-Dade, for example, support groups facilitated by mental health professionals were held for several weeks after work resumed. Mental health information, including what type of emotional reactions were occurring and what help was available, were distributed widely and often.

CONCLUSION

Information technology organizations often deal with crises. Hurricane Andrew pushed those organizations to the forefront of the preparation and response needed at both the University of Miami and at Miami-Dade Community College.

Professionalism, a sense of duty, unusual tenacity, and responsibility, especially as exhibited by Information Technology personnel, helped these institutions recover from this unique and critical disaster.

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INFORMATION TECHNOLOGY: The Revolution Continues

STRATEGIC PLANNING & MANAGEMENT

T2-6

Business Reengineering in Higher Education: Promise and Reality

James H. Porter
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38th Annual
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Business Reengineering in Higher Education: Promise and Reality

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Over the past few years business managers have been told to obliterate, reengineer, transform, break[1] and do all sorts of things to their organizations. Should we be doing the same things within higher education? This paper takes the position that business reengineering has not yet been applied within higher education institutions and, for the foreseeable future, will not be applied to a major university. In addition, process redesign, a specific step in the business reengineering process, should not be applied in most of our institutions of higher education.

Reengineering in Business vs. Reengineering in Higher Education

Business reengin eering can be defined as:

> ...the fundamental rethinking and radical redesign of an entire "business system"—the business processes, jobs, organization structures, management systems, and values and beliefs—to achieve dramatic improvements in critical measures of performance.[2]

While the process described in this definition may apply to business organizations such as, say, manufactures of electric toasters or cold cereal, business reengineering's application to higher education is not clear. If we are to reengineer our universities, what jobs, organization structures and management systems do we radically change? What are the critical performance measures that will dramatically improve? To answer these questions, it may help us to compare a 'business system' to a similar model of a 'higher education system.' One widely accepted business system model is Michael Porter's Value Chain,[3] as shown in Figure 1. One interpretation of Porter's Value Chain is that the *Primary Activities* listed across the bottom, taken together, comprise the *Business Processes* of an organization.

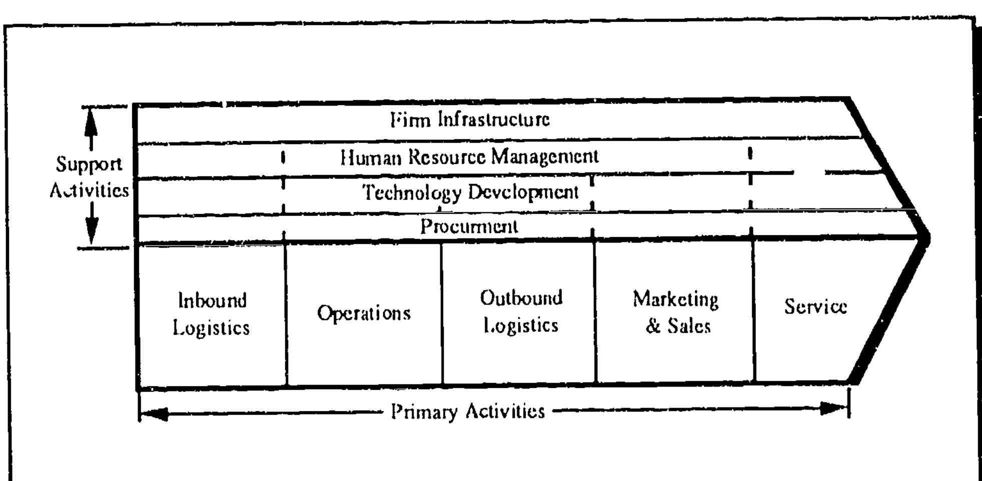

Figure 1. Michael Porter's Value Chain

A comparable model of a university might replace the *Primary Activities* in the bottom half of the Value Chain with *Education* and *Research*—which represent the Core Mission of higher education institutions. In other words, education and research *are* the business processes in higher education. In addition, *General, Student* and *Research Administration* and *Enabling Technology* would replace the *Support Activities* in Porter's Value Chain. This proposed model is presented in Figure 2. (A colleague, who will remain nameless, suggested that Education business process be divided into three primary activities: recruiting, awarding degrees and soliciting donations.)

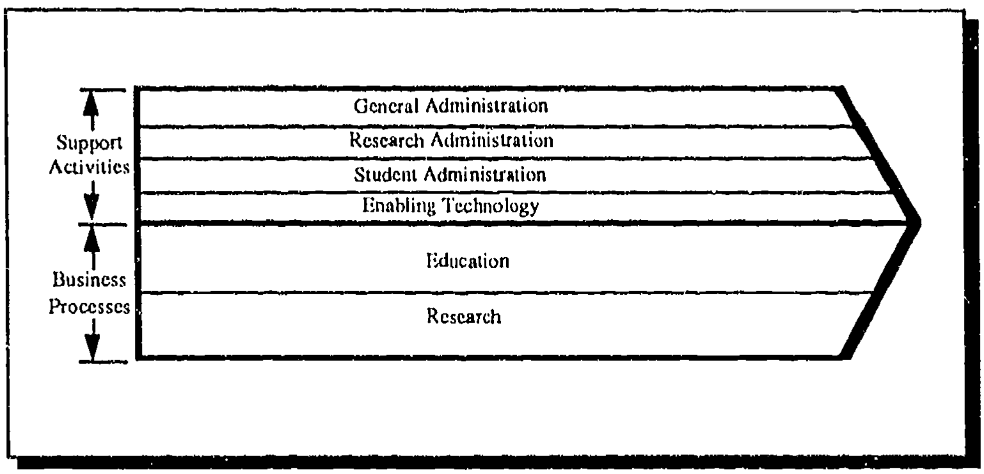

Figure 2. A Proposed Higher Education Value Chain

We can represent the business processes and support activities indicated in the Proposed Higher Education Value Chain in a possibly more meaningful format by organizing them into three tiers as suggested in Figure 3, A Business Model of a University.

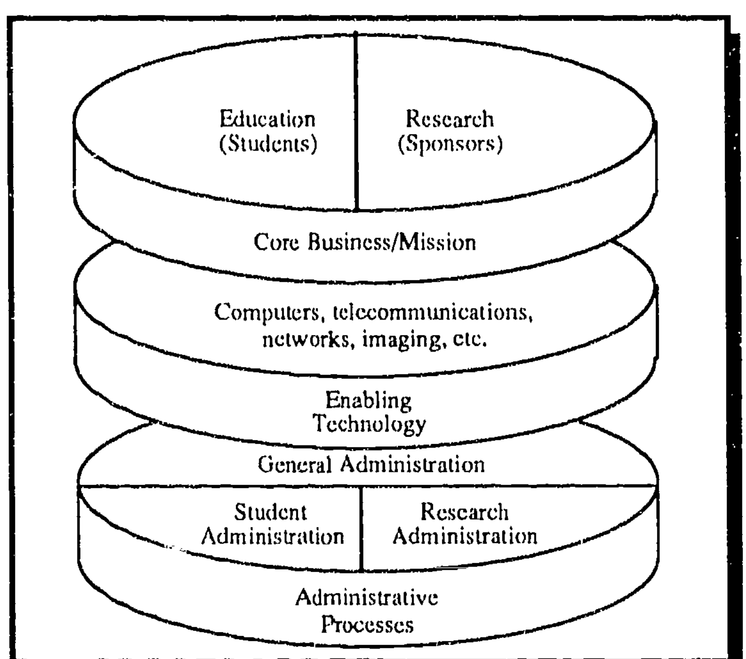

Figure 3. A Business Model of a University

If we accept this three-tier model as a valid representation of a university, then applying business reengineering implies a top-down transformation of all three tiers. To reengineer the university—or any other organization—we ask "What business are we in and what business should we be in? Who are our customers? What products do they need? How should we be organized? What technology do we need to support our radically changed mission?" To answer these questions, we first would rethink the university's mission, including its core business, customers and markets. We would then examine the environment, competitors and market conditions. We then, according to business reengineering theory, might develop a vision of the university as a different organization. Maybe we should do away with the students and become a research-only institution. Maybe we should throw out the students, researchers and administrators and go into real estate development. Or maybe we should....

Sure! Propose taking such actions to the trustees, faculty and alumni of any major research institution and you will be fired, committed, or worse; however, some institutions—notably certain small private and community colleges—have taken reengineering-like actions, due to competitive or survival threatening situations. (Several such examples are presented later in this paper.) An analysis of these few data points suggests that there may be a correlation between size and type of an institution and its propensity to reengineer. One possible model is represented by the continuum proposed in Figure 4.

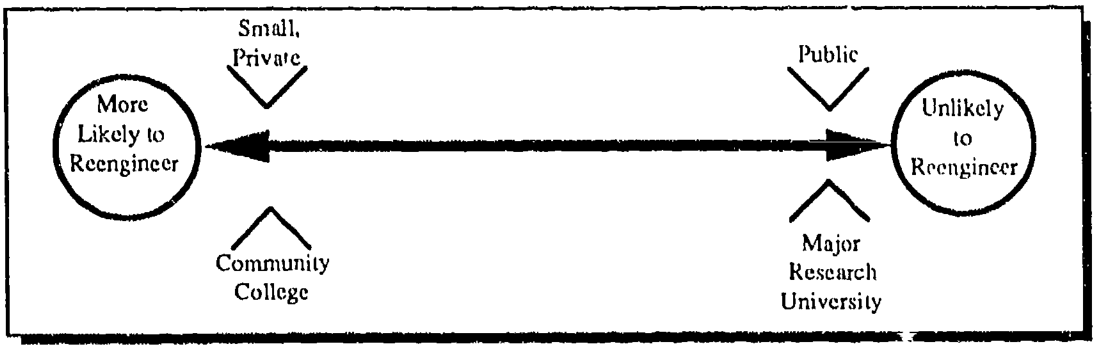

Figure 4. Propensity to Reengineer in Higher Education

As university administrators, what does this model mean to us? It suggests that if we are on the staff of a major research university or public institution that is not in serious trouble, we are probably wasting our time to propose business reengineering. The model also suggests that if we are in a small, private institution or community college and we are under severe financial or marketing pressures, reengineering may be our key to survival.

Business Transformation

In theory, you do not have to make fundamental changes to the institution in order to take advantage of reengineering concepts. Reengineering is, according to some, the culminating phase of a multi-phase process. One such multi-phase process, presented in Figure 5, comes from the Management in the 1990s Research Program at MIT's Sloan School of Management.[4] We will refer to this model as the *MIT 1990s Transformation Model*.

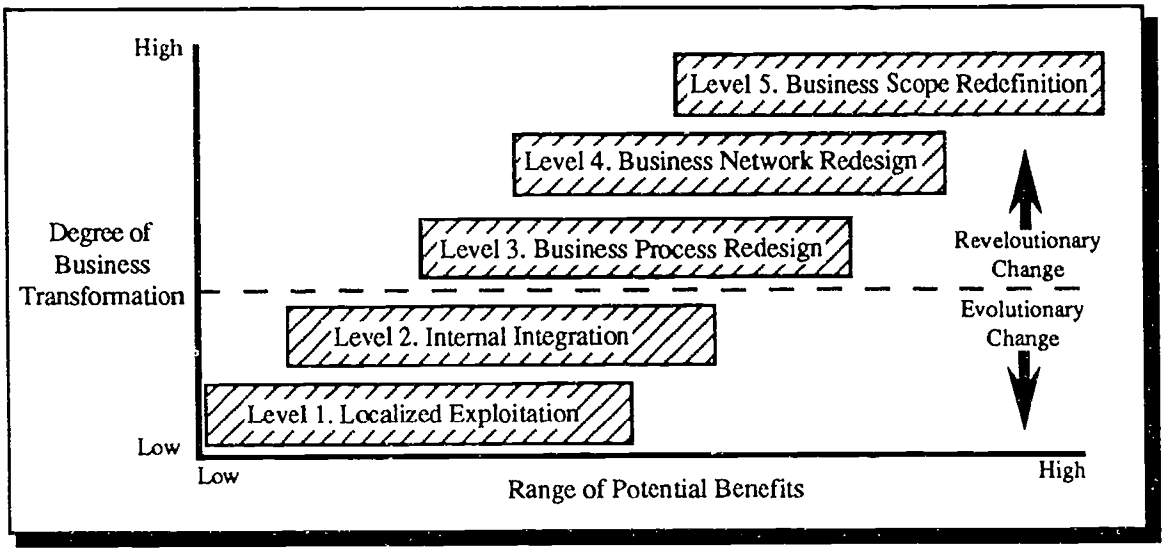

Figure 5. Five Levels of Information Technology-Induced Transformation (MIT 1990s Transformation Model)

The five phases suggested in the MIT 1990s Transformation Model, which takes an information technology perspective, can be described as follows:

Levels 1 and 2 are evolutionary and will result in incremental changes to existing processes.

Level 1 **Localized Exploitation**—The use of computers to improve the efficiency of one business function. Examples include the deployment of stand-alone student systems, financial systems and human resource systems, which are frequently from different vendors, written in different languages, using different databases and sometimes operating on different hardware platforms. Departmental shadow systems—which locally duplicate data from other systems—are another example of localized exploitation systems. While users across an institution may use these systems for transaction input and inquiry, local efficiencies and local control are the real goal of local exploitation systems. This is the current status in many, if not most of our institutions.

Level 2 **Internal Integration**—The interconnection of business activities through a common technological base and shared organizational vision. Level 2 organizations experience efficiency and effectiveness through cost reductions, the creation of value-added services and improved information availability for decision making. Organizational responsibilities are typically adjusted to take advantage of new capabilities. Few of our institutions are at this level.

Most projects currently reported in the university trade press under the rubric "reengineering" and "process redesign" fall into the Level 1 or Level 2 categories.

Levels 3, 4 and 5 in the MIT 1990s Transformation Model are revolutionary and will result in fundamental changes to existing business processes and supporting organizations, with both potential benefits and degree of resulting business transformation increasing as we move to higher levels.

Level 3 **Business Process Redesign**—Business processes are redesigned to take advantage of the enabling powers of information technology—which will result in redesigned organizational roles, reporting relationships and managerial responsibilities. Even if we limit applying this level to only the *Enabling Technology* and the *Administrative Processes* tiers as described in Figure 3, this level will be difficult to achieve by a major university because (1) the need to redesign our administrative processes has not been demonstrated, (2) the benefit from redesigning our administrative processes is not known, and (3) the organizational and management support required to redesign our administrative processes will be difficult to gain. (Remember, according to this model, most of us are at Level 1 and most of the systems and organizational projects we are currently implementing would be placed in Level 1 or Level 2 categories.)

Level 4 **Business Network Redesign**—This is inter-organizational integration through inter-company networks, electronic data interchange, etc. Examples include linking multiple companies' manufacturing and inventory records so that, say, a seat manufacturer knows the production schedule of a car manufacturer and can get the right color and style of seat to the production line just-in-time. There is no equivalent requirement for network redesign, as defined, in higher education.

Level 5 **Business Scope Redesign**—The redefinition of an organization's mission through the capabilities of information technology. When reengineering is applied in the corporate world, it may lead an organization to getting out of its old business or adding new businesses, such as selling information as a product or offering other value added services. In higher education, if we get out of the education and research business, we are no longer in higher education.

The MIT 1990s Transformation Model presents a dilemma in that the definition of business reengineering presented at beginning of this paper would fall somewhere between Level 3 and Level 5 in the Transformation Model (Level 4 should be ignored). Likewise, the definition of process redesign we are using falls somewhere between Level 2 and Level 3. One point the reader should note is that there are different levels of business transformation—and that process redesign and business reengineering are not the same activities. Process redesign is required to achieve business reengineering; however, business reengineering is not required to apply process redesign to an organization.

Change Options

Given the above discussion which states that most organizations are probably at the Local Exploitation level in the MIT 1990s Transformation Model, how can we proceed to change our organizations? Several possible approaches are presented in Figure 6, Business Systems Change Options.

Approach	Action	Management Support Required	Feasibility
Static	Do not make any changes.	No special management support required. (May need management's protection)	Not likely. Always some change.
New System Project(s) (Localized Exploitation)	Implement new administrative applications and/or hardware.	Local sponsor support required throughout project. Little senior management support required.	Doable; but new systems alone do not constitute redesign or reengineering.
Incremental Change via Internal Integration	Move application systems to common architecture/technology.	Little senior management involvement required. Need common vision and good plans.	Many universities working toward Internal Integration.
Administrative Process Redesign	Significant change to administrative processes incorporating the enabling capabilities of information technology	Senior management support required to initiate. Ongoing support required. Changes to organization will be resisted.	Feasible. Possibly not desirable. Benefits not demonstrated.
Business Reengineering	A transformation of the core business. Fundamental change to the mission, markets and products. (Education and research)	Broad, senior management and community support required throughout reengineering effort.	Possible for institutions in a serious financial or competitive trouble. Not likely for major research institutions.

Figure 6. Business Systems Change Options

Using the three-tier model proposed in Figure 2, the MIT 1990s Transformation Model, and the change options outlined in Figure 6, our alternatives include:

- **Change the middle tier:** Change the enabling technology by, say, installing a new computer application. This can be accomplished without disturbing the other two tiers. Indeed, many organizations insist that new administrative application systems must not change current administrative processes. This is a Level 1 approach.

- **Change the bottom two tiers:**
  - **Level 1 change**—Install a computer system or make organizational changes to gain efficiency in one area or department. Shadow systems developed by, say, a unit, division or department are Level 1 projects, as are financial, human resources and student systems that are not integrated with other administrative systems through a common architecture and database.

- **Level 2 change**—Integrate the current administrative processes using a common technological base and shared organizational vision. This will usually result in technology-driven change and will redefine some administrative organizational responsibilities. This is the path most universities should take—and are taking—no matter whether they call their effort a reengineering, transformation, redesign, or whatever project.

- **Administrative process redesign**—Redesign the administrative processes. If the administrative processes can be redesigned, the result will be changes in the technology and process tiers—but no major impact on the top tier. True administrative process redesign will be difficult to achieve in a university due to lack of support, opposition by vested interests, and limited demonstrated realizable benefits. Most universities should use the evolutionary, Level 2 approach.

- **Change all three tiers:** Reengineer the core business processes—education and research—and all supporting organizations including redesigning the administrative processes. Requires Board of Trustees and faculty support that will be impossible to achieve in most universities.

Level 2 of the MIT 1990s Transformation Model, Internal Integration, is the transformation activity applicable to most of our institutions. It allows us to take advantage of the enabling powers of information technology without significantly threatening the mission-related activities of the top tier that might result from reengineering or invoking the resistance resulting from organizational changes that would result from administrative process redesign.

Reengineering Experiences in Higher Education

There are no examples in the literature of business reengineering, as defined in this paper, being applied within higher education. I can find no documentation of a university that has gone through a *classic* business reengineering process.[5] Some institutions have reportedly discussed reengineering and others have taken reengineering-type actions due to financial or other pressures. Business reengineering-like examples reported in the press include:

- Small colleges, especially private institutions, are merging with larger colleges. For example, Mundelein College and Mallinckrodt College merged with Loyola University. Between 1988 and 1992 over 30 mergers were completed.[6]

- Tougaloo College, under the leadership of its President, pulled together faculty, alumni and administrators to establish a strategic plan to address serious financial problems. One action Tougaloo took was to lease college owned property to businesses wishing to expand.[7]

- From 1985 to 1990, St. Mary of the Plains College operated a vocational training program in conjunction with a truck-driving school. High student loan default rates by students in the vocational program are a major reason the college closed in June 1992.[8]

- Columbia University's Martin Meisel, member of a strategic planning committee consisting of administrators, faculty and students, was quoted by the *New York Times* as stating that "What might emerge [from the planning process] is likely to be a different institution." However, Columbia's President, Michael Sovern, is quoted in the same article as saying "I don't think that the changes are likely to be the sort that anyone outside the institution will see."[9] {It will be interesting to see how these differences are resolved.}

- Numerous community colleges have added traditional and non-traditional programs to meet specific local needs.

Possible administrative process redesign examples are easier to find. CAUSE, for instance, recently surveyed its membership with the following question:

> Has your IT organization engaged in any reengineering projects on campus, i.e., looked at ways to make administrative processes more effective and efficient and to incorporate information technology into these operations?[10]

The question, as phrased, reflects the existing confusion over the differences between business reengineering and process redesign that this article is attempting to address. The five projects highlighted in *CAUSE/EFFECT* would be classified as Level 1 or Level 2 projects using the MIT 1990s Transformation Model. Four of the reported administrative process redesign efforts are summarized in Figure 7.

University	Process Being Redesigned	Methodology Followed	Remarks
Virginia Tech	Human Resources and Financial Aid	Consulting Model. Traditional business analysis, design and development.	New department established to address administrative systems and related opportunities.(Level 1)
Yale University	Human Resources and Payroll	Applying Expert Technology	Paper forms reduced by over 50% (Level 1)
University of Pennsylvania	University's Financial Management Process	Three-pronged process: (1) Develop an information architecture (2) Identify Business Requirements 3) Acquire integrated administrative applications over time	Sponsored by Vice Provost for IS and Vice President for Finance (Level 2)
University of Michigan	Graduate Student Aid Process	Joint Application Definition (JAD) and TQM	(Level 1)

Figure 7. Selected Administrative Technology Projects From CAUSE/EFFECT

Another administrative process redesign example is a major system implementation project at Columbia University. This activity was reported in the November 9, 1992 *Computerworld* under the title "Assignment: Re-engineering".[11] While the author used the term "re-engineering" to describe the ambitious undertaking at Columbia, what is described in the article is an administrative process redesign project which would be classified as a Level 2 project in the MIT 1990s Transformation Model.

Reengineering in the Business Press: Title Inflation

One problem we have in separating business reengineering efforts from traditional system projects is caused by the business press. Take, for example, the following scenario based upon imaging:

> Imaging i. a technology that will receive much press coverage over the next few years. Most imaging applications are put in place to: (1) route electronic copies of forms for review, action or approval, (2) track the status of these forms, and (3) provide electronic filing and retrieval of these forms.
>
> The forms used in an imaging application are about the same as the pre-imaging forms. The people reviewing the forms are the same people who reviewed the paper forms. The same decisions are being made. If the unit using imaging were placed in a black box, the outside world would notice little difference. The only indication that imaging was being used would be faster decisions coming out of the box and more money being sucked into the box.
>
> This is an example of a Level 1, Local Exploitation application of technology if there ever was one; however, you can be sure that any article covering imaging will declare the project to be a reengineering project.

Conclusions and Recommendations

In my investigation of reengineering in higher education, I felt kinship with a cryptozoologist looking for sasquatch or the Loc Ness monster. A cryptozoologist, in searching for these possibly mythical beasts, considers "...reports by eyewitnesses or indigenous peoples; descriptions in folk stories, travelers' accounts, old manuscripts and legends...."[12] As a cryptoreengineerist, I have talked with indigenous university computing peoples, listened to folk stories (presentations at conferences) and legends (from vendors) and reviewed old manuscripts (articles in the trade press) and have yet to find business reengineering in higher education. Maybe someday, someone will capture a real live higher education business reengineering specimen.

Is there anything wrong with using the terms *reengineering* and *redesign* if we are actually engaging in Level 1 and Level 2 projects? If it helps you to sell the project to management or if you feel better about having a project with reengineering or redesign in its title, by all means, use the terms; however, if you really believe that you are going to significantly change your university's business or its administrative processes or you are setting management's and user's expectations for important and major changes, you are in for serious problems.

As the administrative and technology professionals in our respective institutions, we must be careful to understand what is implied as we consider applying concepts from the corporate world to higher education. Sometimes we lose our perspective and assume that the administrative processes we support *are* the university.

Business reengineering has had a major impact in the corporate world but will not be applied within our universities—except in an institution in serious trouble. Administrative process redesign should not be attempted since there is no demonstrated need, no documented benefit and no organizational support for such an effort. Rather than attempting business reengineering or process redesign, we should focus on achieving Level 2, *Internal Integration* as described in the MIT 1990s Transformation Model. Let us use information technology to help the administrative organizations we have in place achieve their potential before we attempt major changes through redesign or reengineering.

Footnotes

[1]Michael Hammer, "Reengineering Work: Don't Automate, Obliterate," *Harvard Business Review*, July-August 1990; Dorine C. Andrews and Susan K Stalick, "Business Reengineering," *American Programmer*, May 1992; Richard L. Nolan, "What Transformation Is," *Stage by Stage*, Sept-Oct 1987; Robert Kriegel, *If it Ain't Broke, Break It*, (New York: Warner Books, 1991).

[2]Michael Hammer and James Campy, "What is Reengineering," *Information Week*, 5 May 1992, p 10.

[3]Michael Porter, *Competitive Strategy*, (New York: Free Press, 1980), p 37.

[4]Michael Scott Morton, *The Corporation of the 1990s: Information Technology and Organizational Transformation* (New York: Oxford University Press, 1991), pp. 122 to 158.

[5]In addition to searching the literature, we corresponded, via e-mail, with authors who have in the past addressed reengineering in higher education and we also surveyed several e-mail-based special interest groups including TQM, Executive Information Systems and Data Administration lists. The requests were personal and contained no indication that information provided might be included in a paper on the subject; therefore, the responses are considered private. I believe it is fair, however, to state that no person responding could guide me to an example of business reengineering in higher education.

[6]Karen Grassmuck, "More Small Colleges Merge With Larger Ones, but Some Find the Process Can Be Painful," *The Chronicle of Higher Education*, September 18, 1991, p A1.

[7]Jaschik, "In Tight Economy, Tougaloo Shows How Black Institutions Can Use Strategic Planning to Aid Their Special Missions," *The Chronicle of Higher Education*, October 2, 1991, p A1.

[8]"Financial Problems Force College to Close in June," *The Chronicle of Higher Education*, March 4, 1992, p A6.

[9]Anthony DePalma, "Short of Money, Columbia U. Weighs How Best to Change," *The New York Times*, May 25 1992, p1, 18.

[10]"Readers Respond," *CAUSE/EFFECT*, Fall 1992, pp. 49-50.

[11]Melinda-Carol Ballou, "Assignment: Reengineering," *Computerworld*, November 9, 1992, pp. 71, 73.

[12]Peter Monaghan, "Cryptozooiogists Defy Other Scientists' Skepticism to Stalk Beasts Found in Legend, Art, and History," *The Chronicle of Higher Education*, February 10, 1993, pp. A7 to A9.

Bibliography

Readers interested in additional readings on business reengineering and process redesign are referred to the bibliography contained in CAUSE Professional Paper Series, #9 (James I. Penrod and Michael G. Dolence, *Reengineering: A Process for Transforming Higher Education* (Boulder, Colorado: CAUSE, 1992), pp. 28-31.) The paper contains an in-depth discussion of business reengineering concepts in the literature; however, the paper does not recognize that *process redesign* and *business reengineering* are very different activities.

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INFORMATION TECHNOLOGY: The Revolution Continues

STRATEGIC PLANNING & MANAGEMENT

T4-6

Information Technology Issues in the 1990s: An Analysis from a CAUSE Postcard Survey for 1992/93

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Introduction

There is an old saying that the only things we can count on are death and taxes. In higher education, it is also a good bet that change will be a key word for the remainder of the twentieth century. Finances, faculty issues, deferred maintenance problems, diversity, student financial aid, political correctness, global issues, and tuition are only a few of the issues that will be considered during the 1990s. Within this framework of uncertainty, the senior computing person has to operate proactively and reactively to the changing needs of her/his constituency. With that in mind, many surveys of the key issues confronting the information technology leader are undertaken. The main purpose of these surveys is to provide direction and insight for IT managers. Most surveys of this type are taken by business and industry and while the comparisons with issues in higher education are important, it is significant to look at the issues directly facing higher education and how relevant they are perceived to be by the people who are senior tofficers with IT responsibility.

The issues that were included in this CAUSE postcard survey were derived from the authors' experiences, from reviews of current literature dealing with IT issues facing industry and higher education, and from a review of the responses to a similar survey taken in 1991/92. (A CAUSE postcard survey is designed to be short and fit on one side of a postcard.) The survey was also designed to allow participants to list and rank other issues which were deemed to be important IT issues for their campus in the 1990s. Several new issues were included in the 1992/93 survey based on the numbers of people who included them in the other issues category from 1991/92, client/server, downsizing, and quality issues. Data from the CAUSE Institution Database (ID) were downloaded and merged with the postcard data. This allowed the researchers to analyze the data based on various institutional characteristics, including size, control (public or private), and Carnegie classification. (For the purposes of this study, institutions have been grouped by the categories used in the classification of US. institutions of higher learning by the Carnegie Foundation for the Advancement of Teaching. Categories Comprehensive I and II were combined under the heading "Comprehensive," Doctoral Granting I and II under "Doctoral," Liberal Arts I and II under "Liberal Arts," and Research I and II under "Research.")

Survey Instrument

One of the many CAUSE member services is the Postcard Survey Service. Members can conduct informal surveys of other CAUSE members to collect information through a survey postcard sent to all member campuses. Members return these pre-addressed postcards either to the member requesting the information or to the CAUSE national office. While this survey

was instituted by Dr. M. Lewis Temares, Vice President and CIO at the University of Miami, the survey was mailed back to the CAUSE national office and data entry was handled by Ben Zastrocky, CAUSE Research Assistant for Information Resources. Data analysis was performed by Dr. Temares and Dr. Michael Zastrocky, CAUSE Vice President. This survey was mailed to 1038 institutions of higher learning in the US. and to all CAUSE international member campuses. The response rate was 52.8 % with 548 completed postcards received. This compares favorably to the 1991/92 survey where 888 surveys were mailed and 503 returned for a 56.6% response rate. The following questions were included on the postcard survey:

CAUSE Postcard Survey: IT Issues in the 1990s

Rank the following information technology issues in order of importance to you in the 1990s. (1 = greatest importance. Use the "other" line if an issue you consider important isn't listed.)

_____Security Issues

_____Reengineering

_____Networking

_____Staff Development and training

_____Aging Systems

_____Effectively coping with limited resources

_____Developing an IS strategic plan

_____Quality issues

_____Justifying the value of IS

_____Downsizing

_____Client/Server

_____Other: ______________________________

____

Institution name: __________________________

____

Summary of Results

Networking and effectively coping with limited resources are identified as the most critical issues facing higher education during the 1990s as reported in this year's survey of CAUSE institutions. This follows very closely the results from the previous year's survey. What is interesting is that the ranking of these two issues was generally the same for both surveys regardless of size, Carnegie classification, or control (public versus private). The one exception from this years survey was by size. Institutions with an FTE greater than 18,000 FTE rated "Coping With Limited Resources" (49% ranked it in their top three) higher than "Networking" issues (43%) for 1992/93 .

Several new issues were added to the survey for 1992/93, Client/Server, Downsizing, and Quality Issues. Of the new issues Client/Server was ranked most important of this group. Overall, 30% ranked Client/Server issues in the top three while only 15% ranked Quality in the top three, and 14% ranked Downsizing in the top three.

While "Justifying the value of IS" was at the bottom of the ranking of the top three for 1992/93 at 14%, this was up from 10% who ranked it in the top three on the 1991/92 survey.

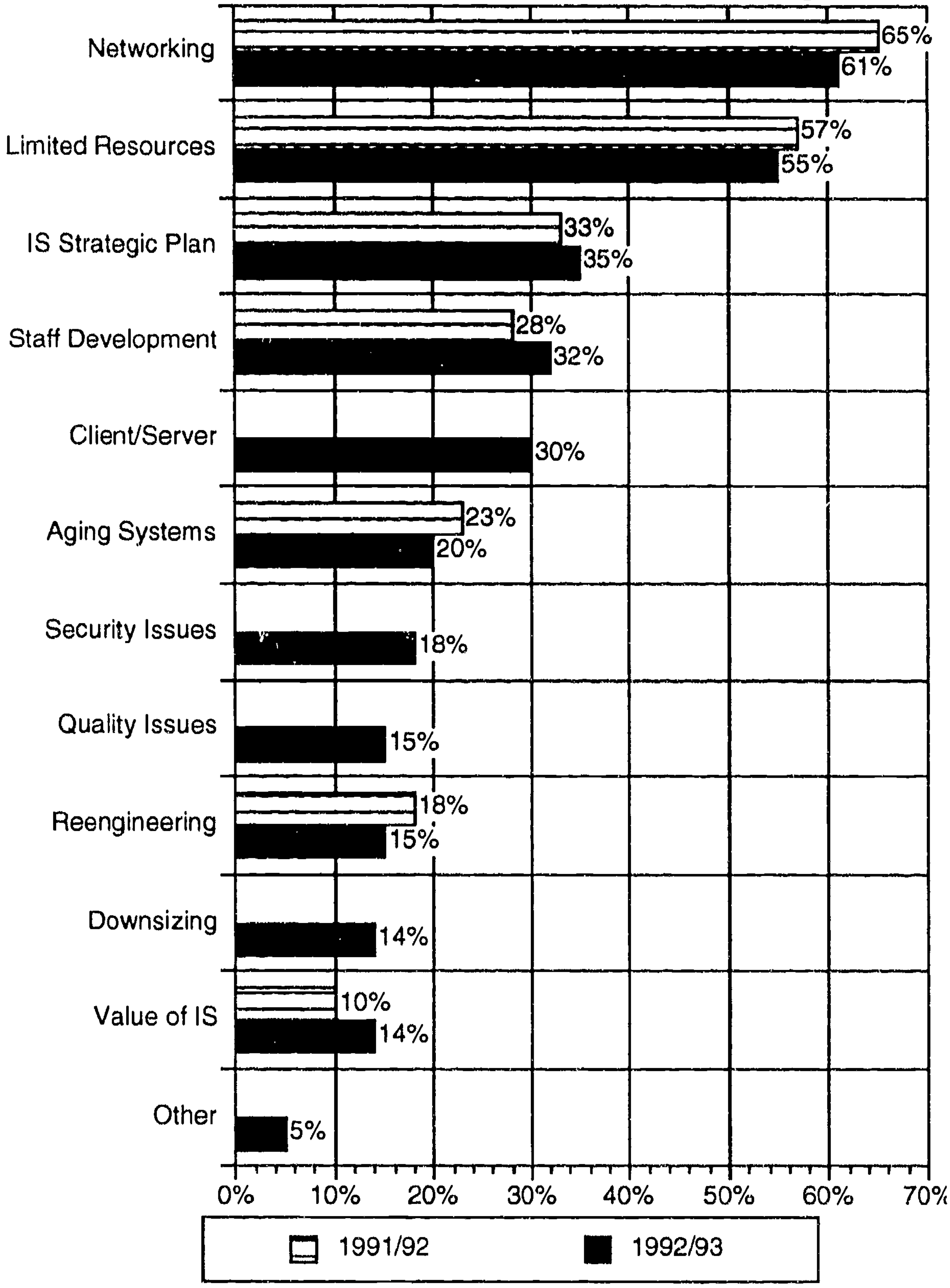
It is interesting to note that the greatest spread between the ranking of the top three by Carnegie Classification was with the issue of Reengineering. 33% of the Research universities ranked it in their top three, while only 7% of the 2-Yr.. colleges ranked Reengineering in their top three. Another interesting spread was with the issue of Networking. 71% of the smallest institutions (FTE≤2,000) ranked this issue in their top three while only 43% of the largest institutions (>18,000 FTE) ranked Networking issues in their top three list.

The differences between public and private institutions were small. The greatest difference came with the issue of "Coping with limited resources" which was ranked in the top three by 53% of the private institutions and 58% of the public institutions.

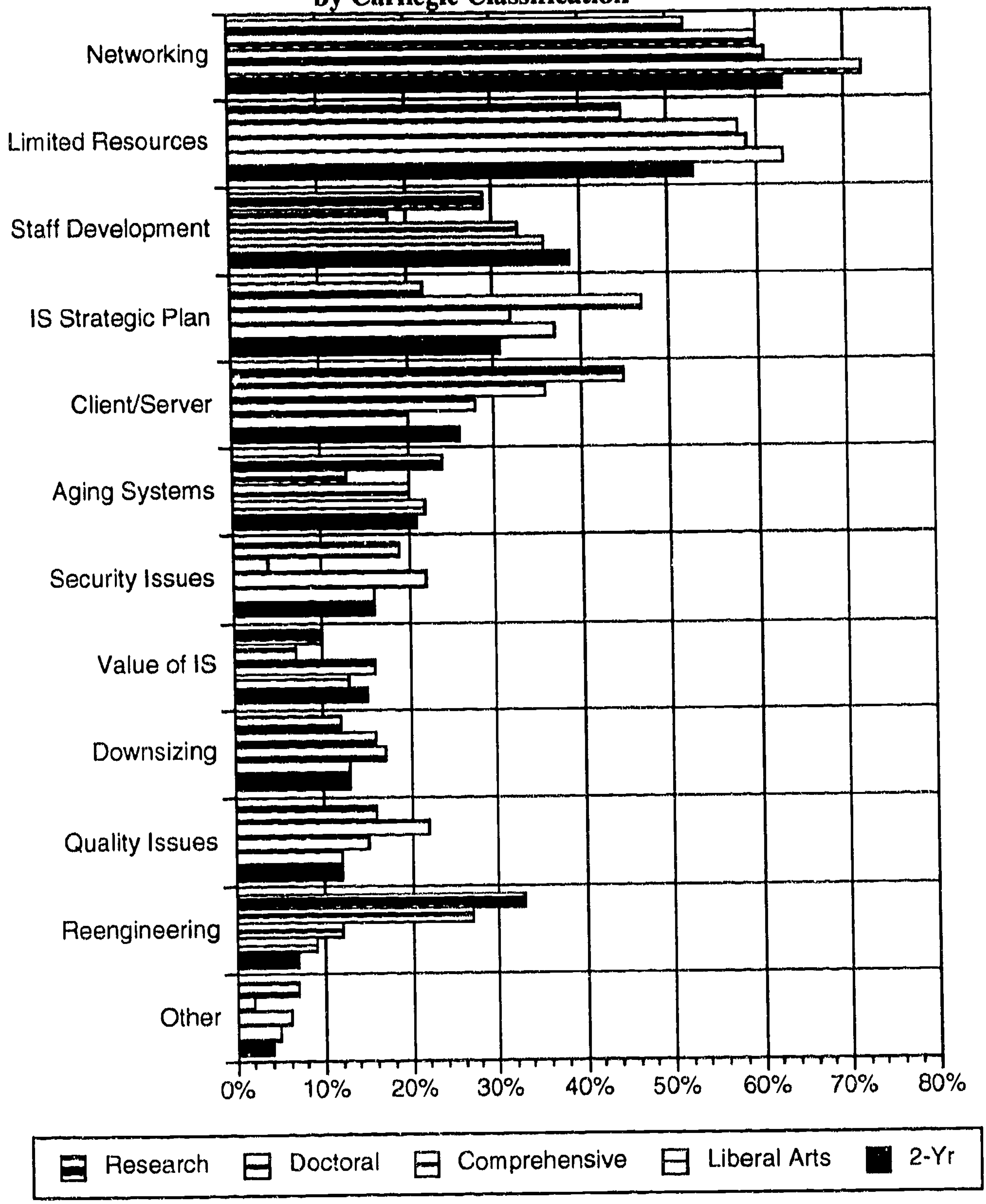
Differences between the categories that were listed at the bottom were quite different. For example, 50% of the 2-Yr. colleges ranked "Coping With Limited Resources" in the bottom four, while only 1% of the Liberal Arts colleges, 5% of the Comprehensive, 4% of the Doctoral Granting, and 7% of the Research Universities placed it in the bottom four.

The first set of charts indicate the ranking of all responses in the top three category based on size, control, and Carnegie classification. The second set indicates the ranking of all responses in the bottom four categories based on the same characteristics. The last set of charts is the actual frequency distributions of all responses. Finally, an alphabetized list of all responses to the "other" category is included and provides another view of the important issues facing the people who manage information technology in higher education during the 1990s.

Percent of All Institutions Who Ranked Each Issue ≤3 (Top Three)



Percent of Institutions Who Ranked All Issues ≤3 (Top Three) by Carnegie Classification



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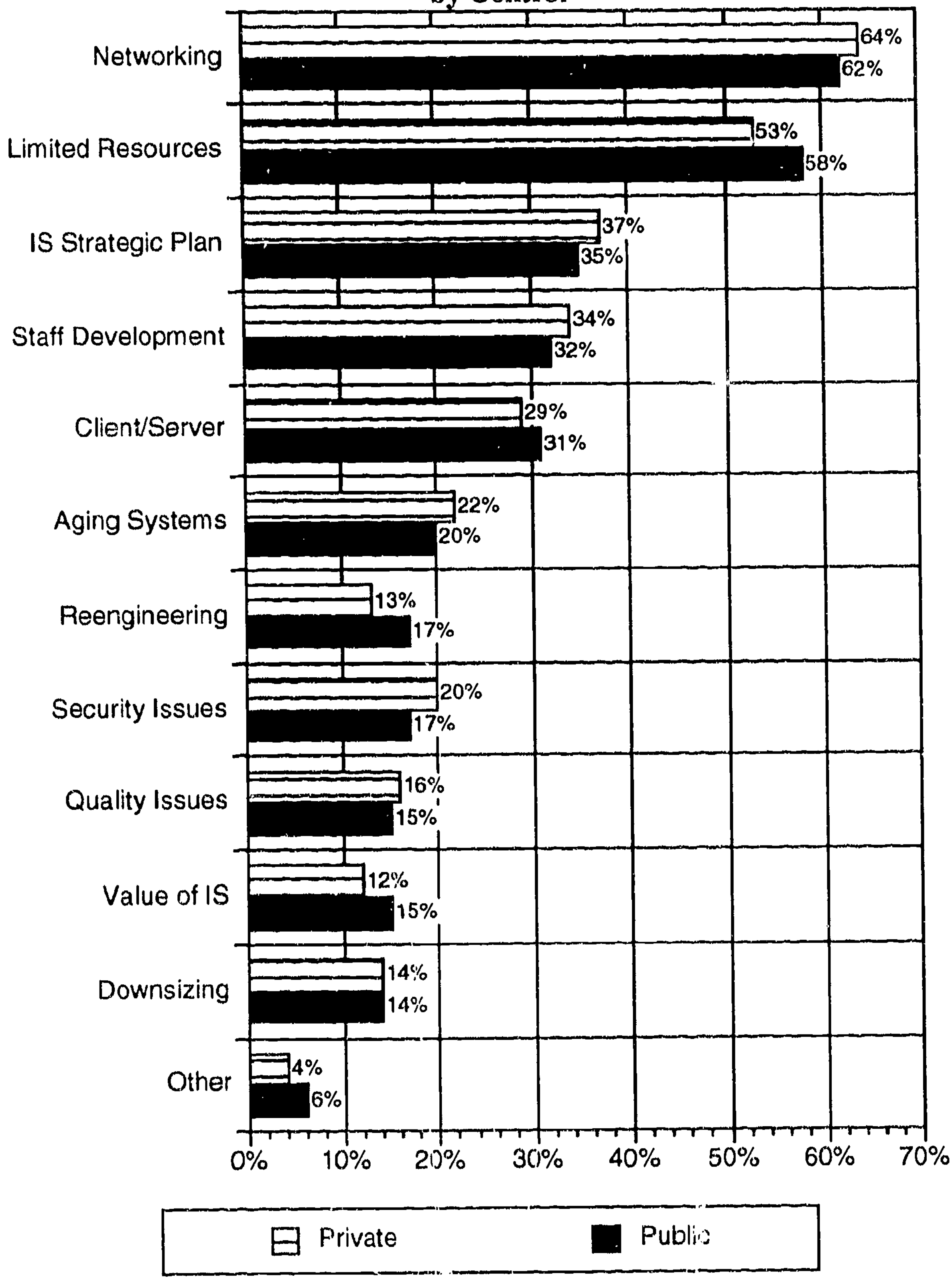
Percent of Institutions Who Ranked All Issues ≤3 (Top Three) by Control



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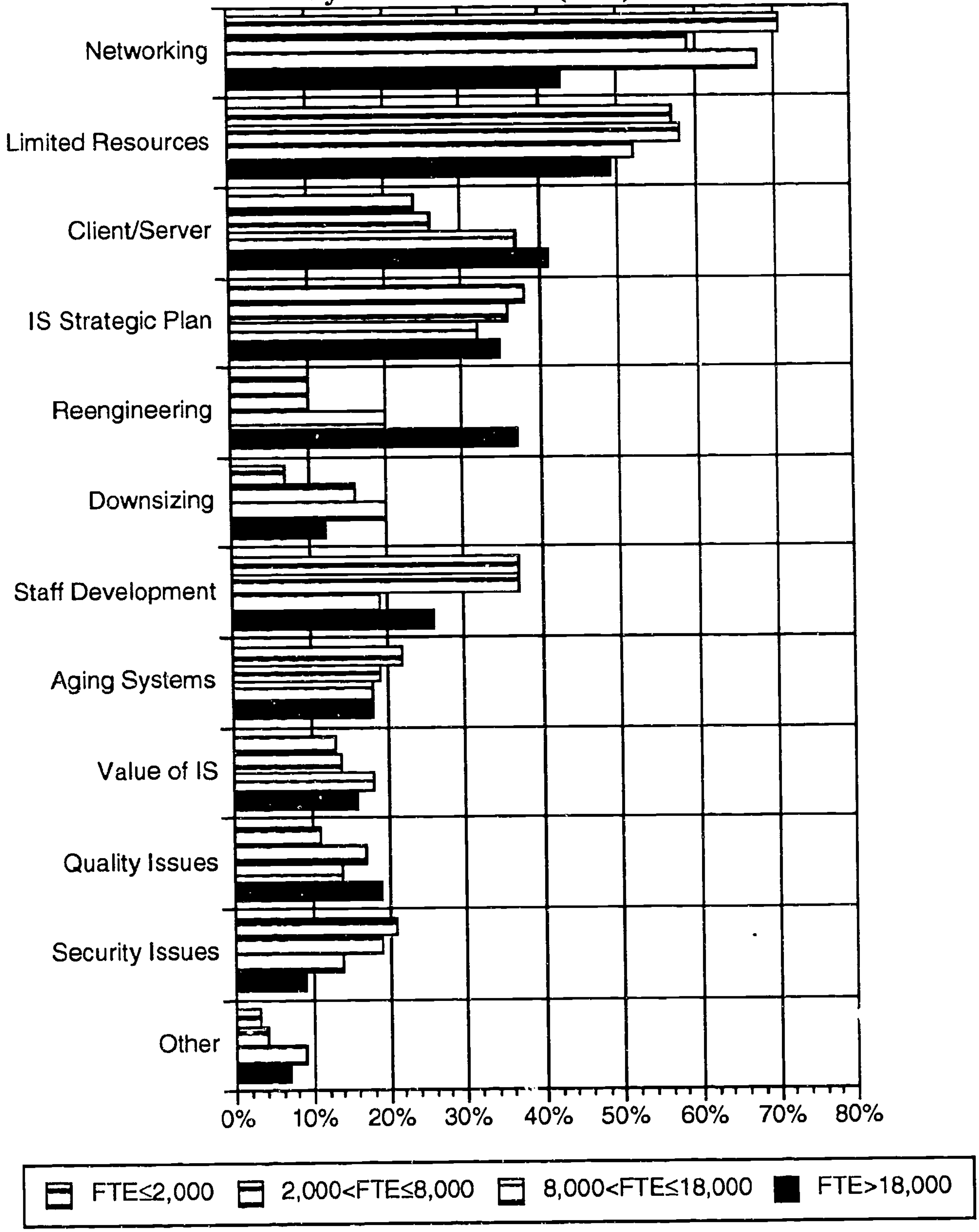
Percent of Institutions Who Ranked All Issues ≤3 (Top Three) by Institutional Size (FTE)



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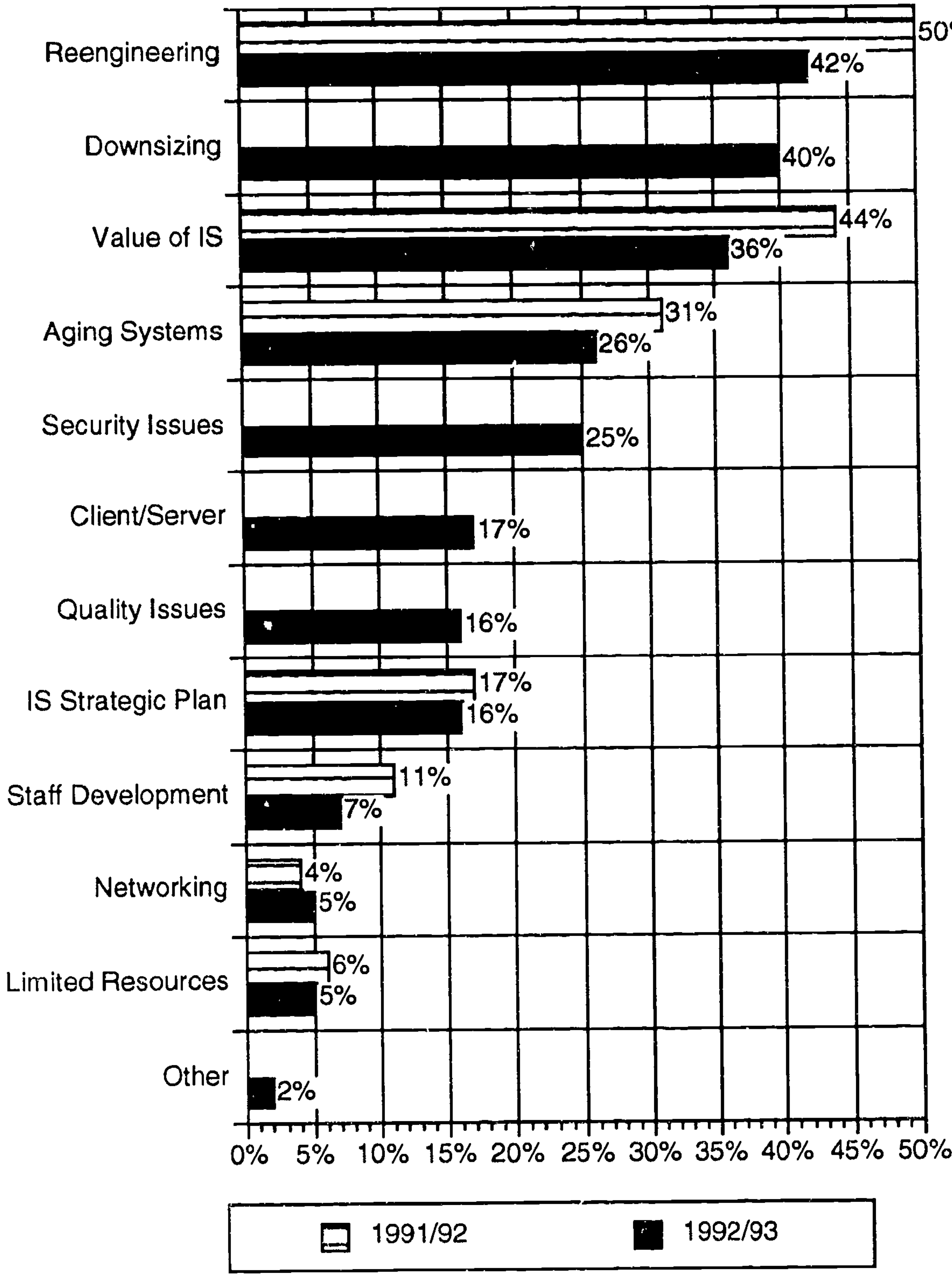
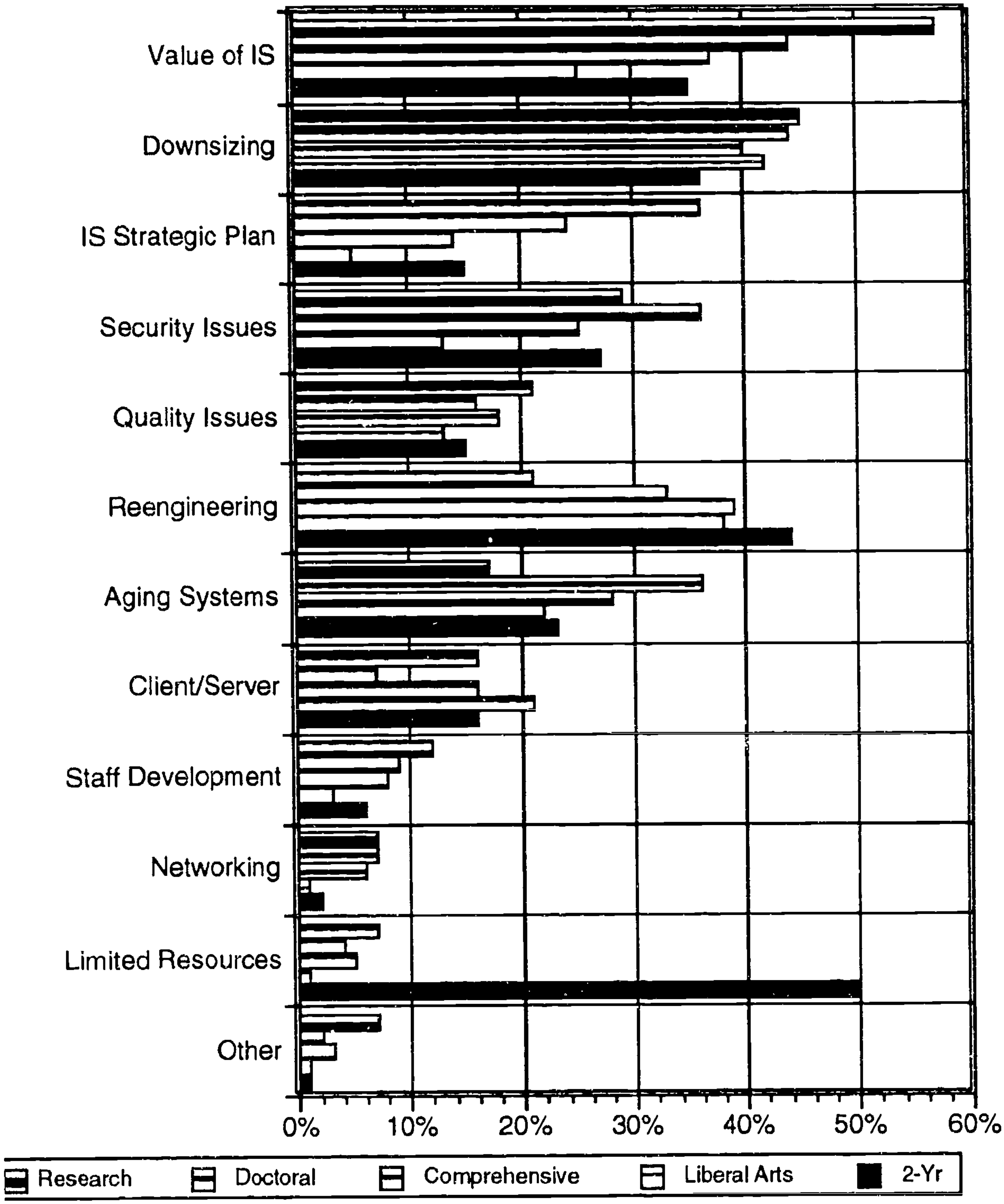
Percent of Institutions Who Ranked All Issues ≥8 (Bottom Four)



Percent of Institutions Who Ranked All Issues ≥8 (Bottom Four) By Carnegie Classification



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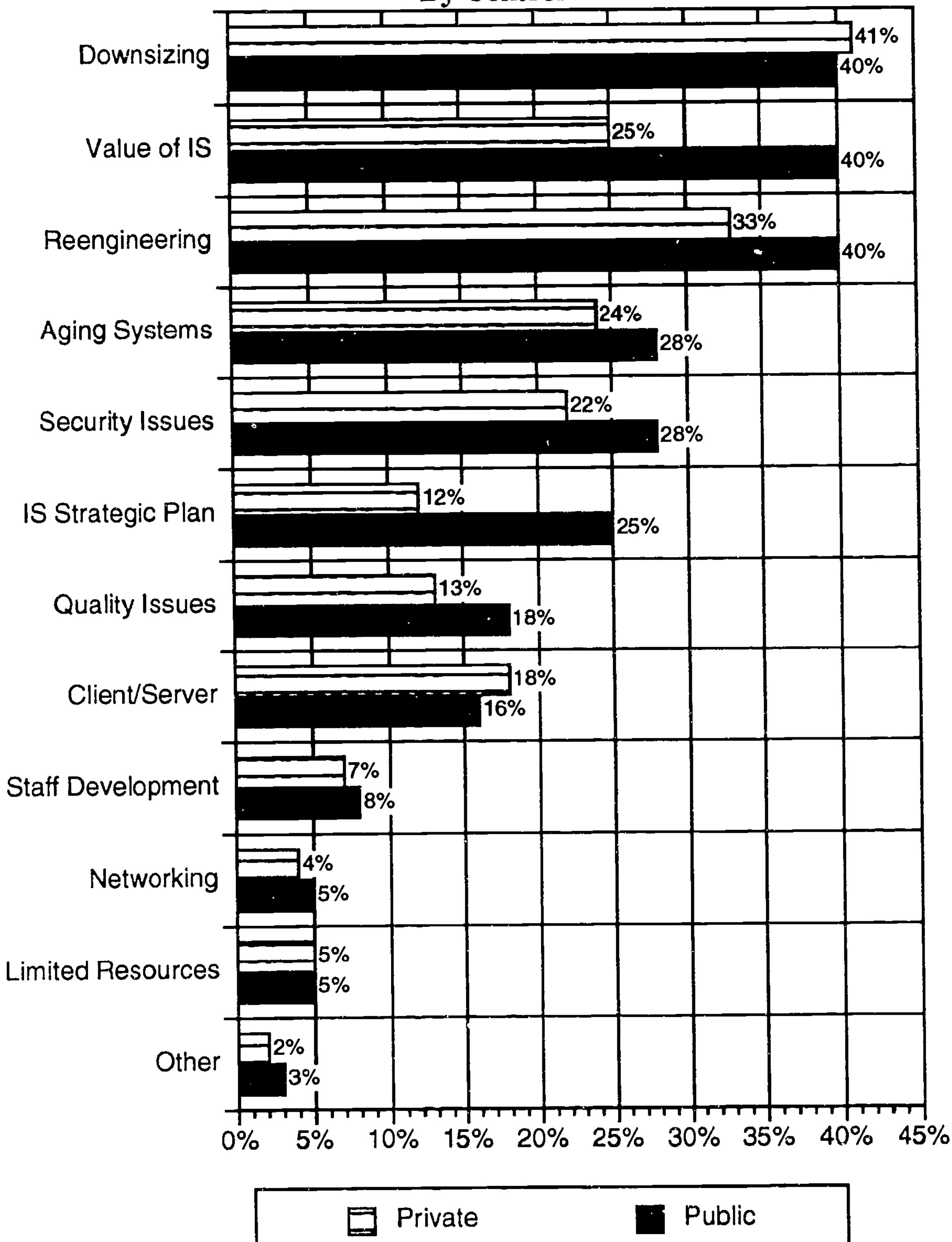
Percent of Institutions Who Ranked All Issues ≥8 (Bottom Four) By Control



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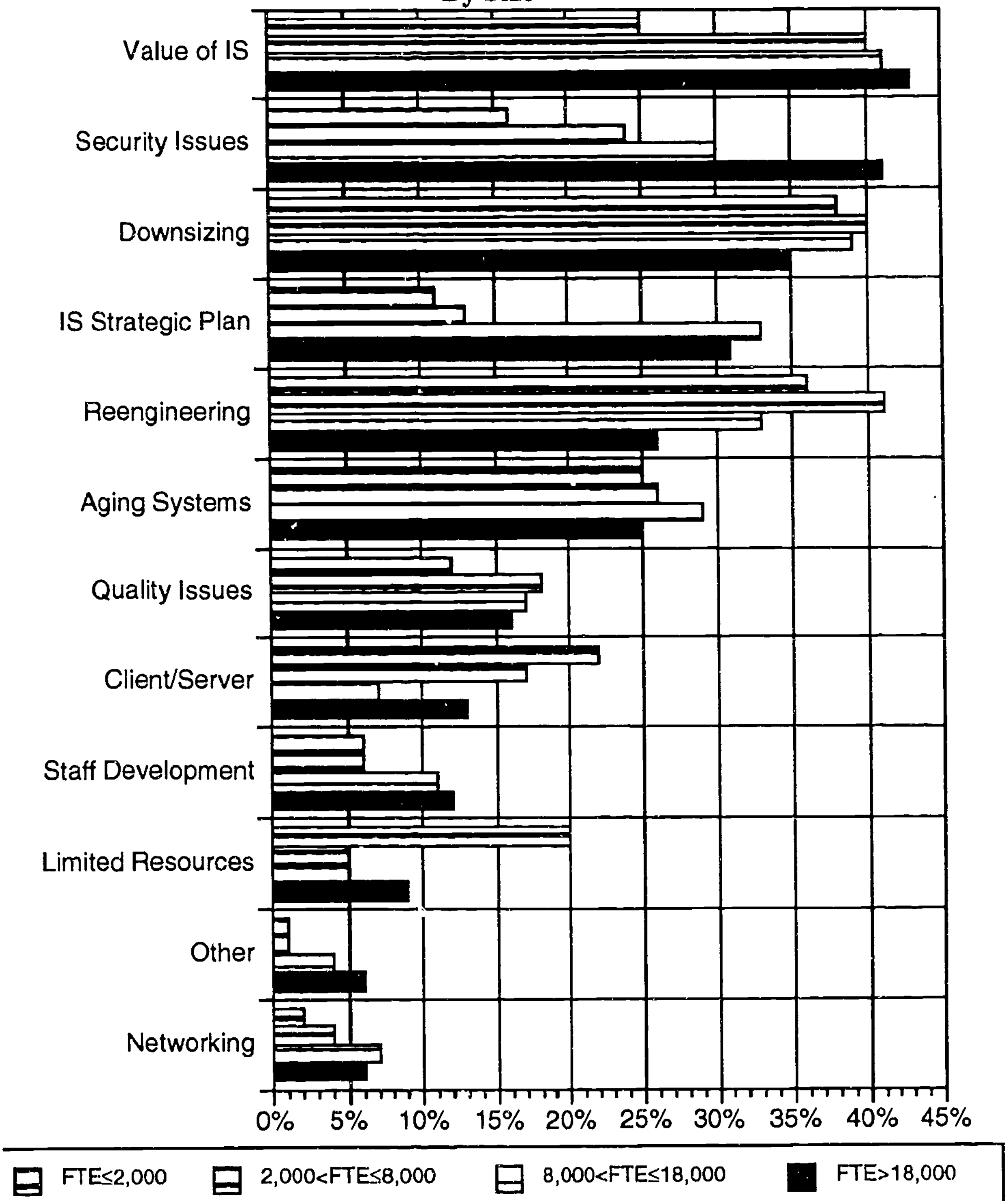
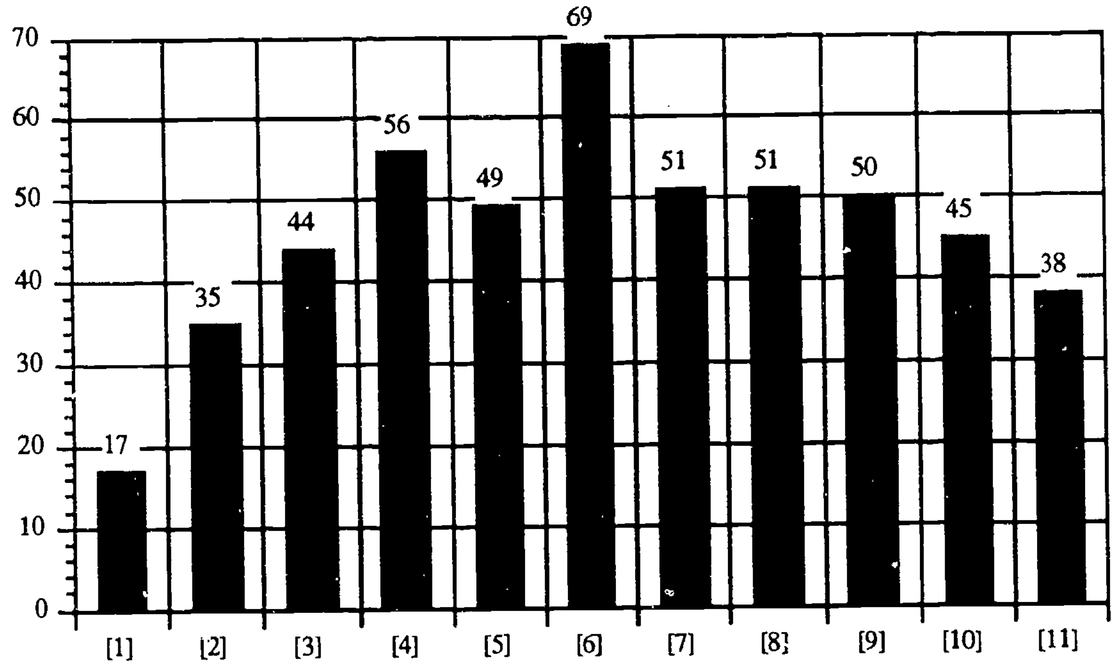
Percent of Institutions Who Ranked All Issues ≥8 (Bottom Four) By Size

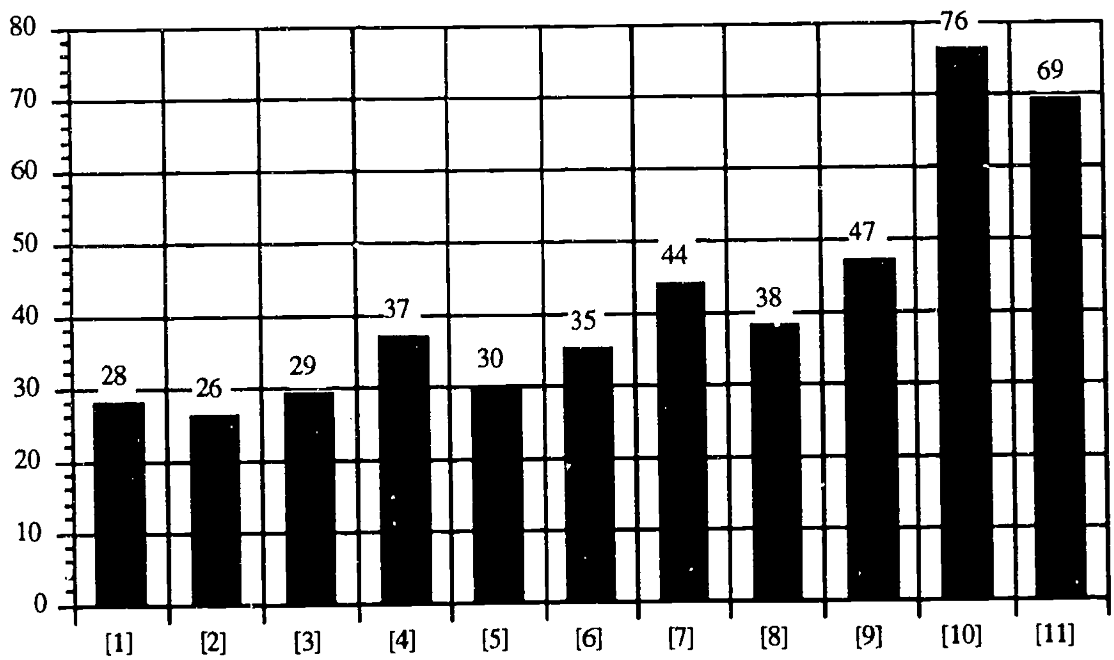


Frequency Distributions
For All Institutions

Security Issues



Reengineering



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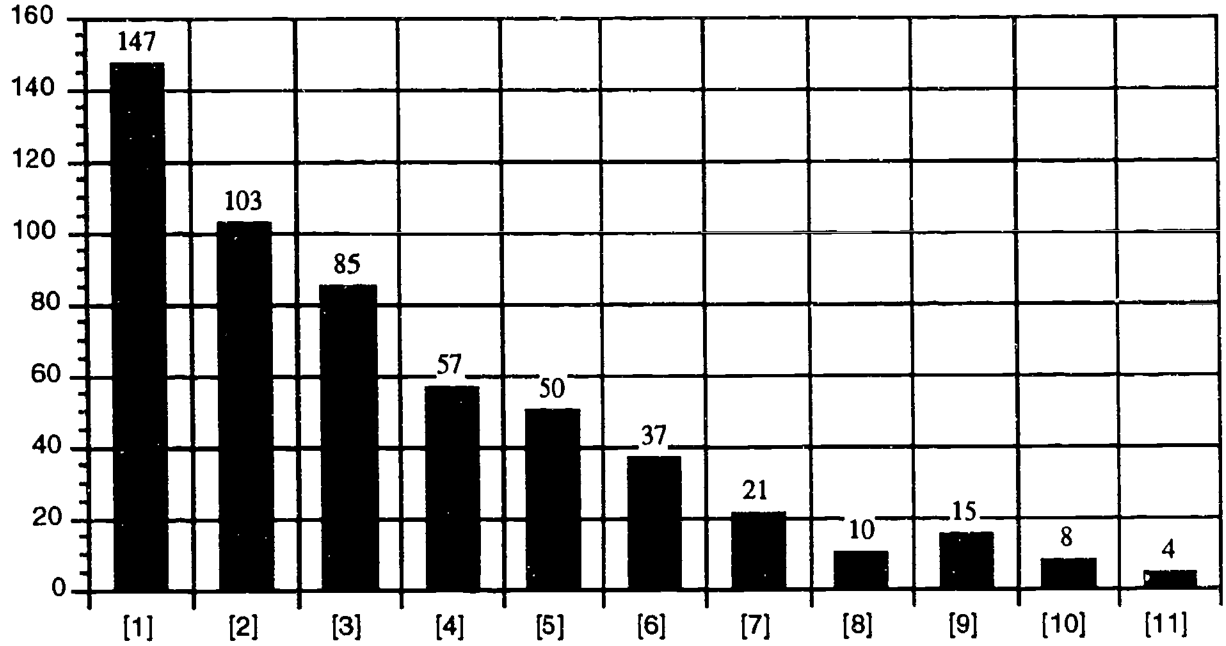
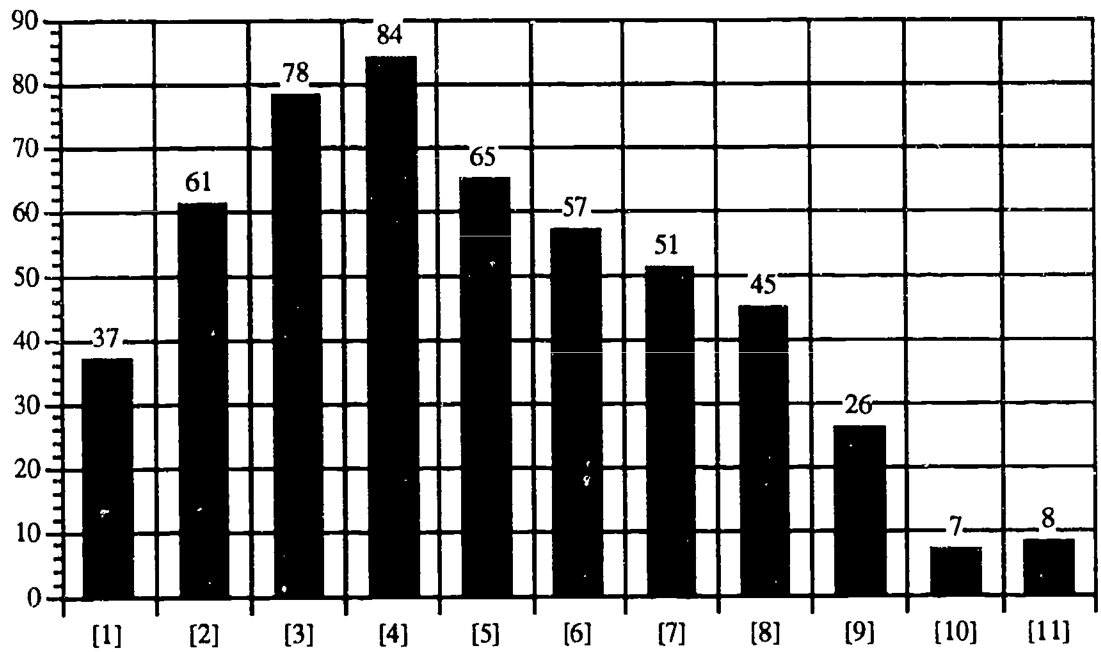
Networking



Staff Development and Training



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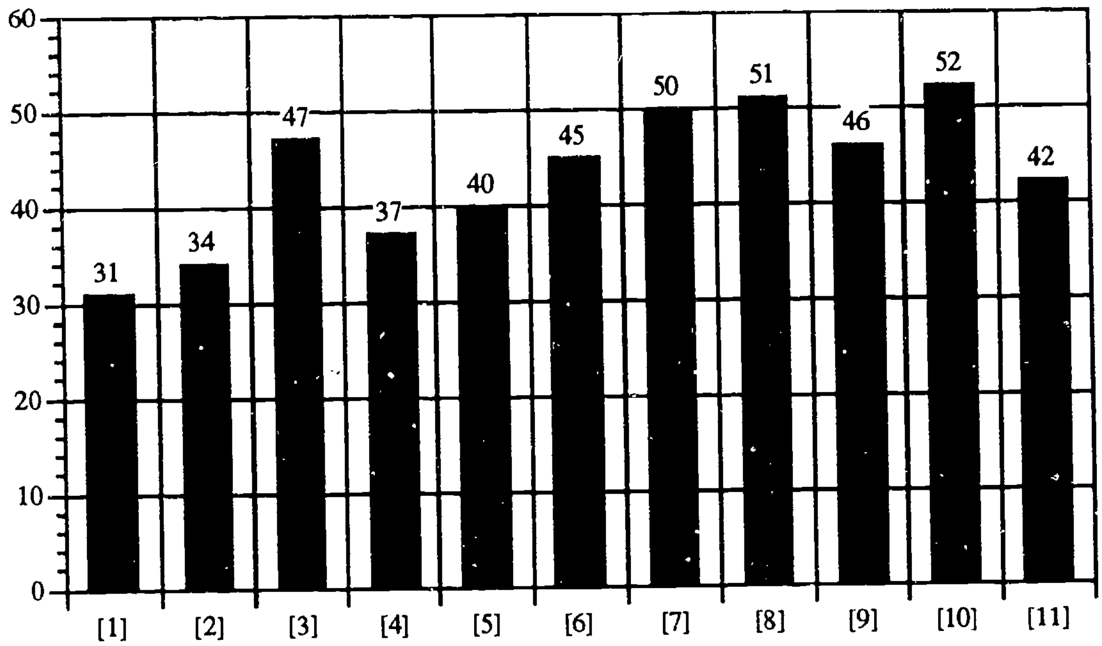
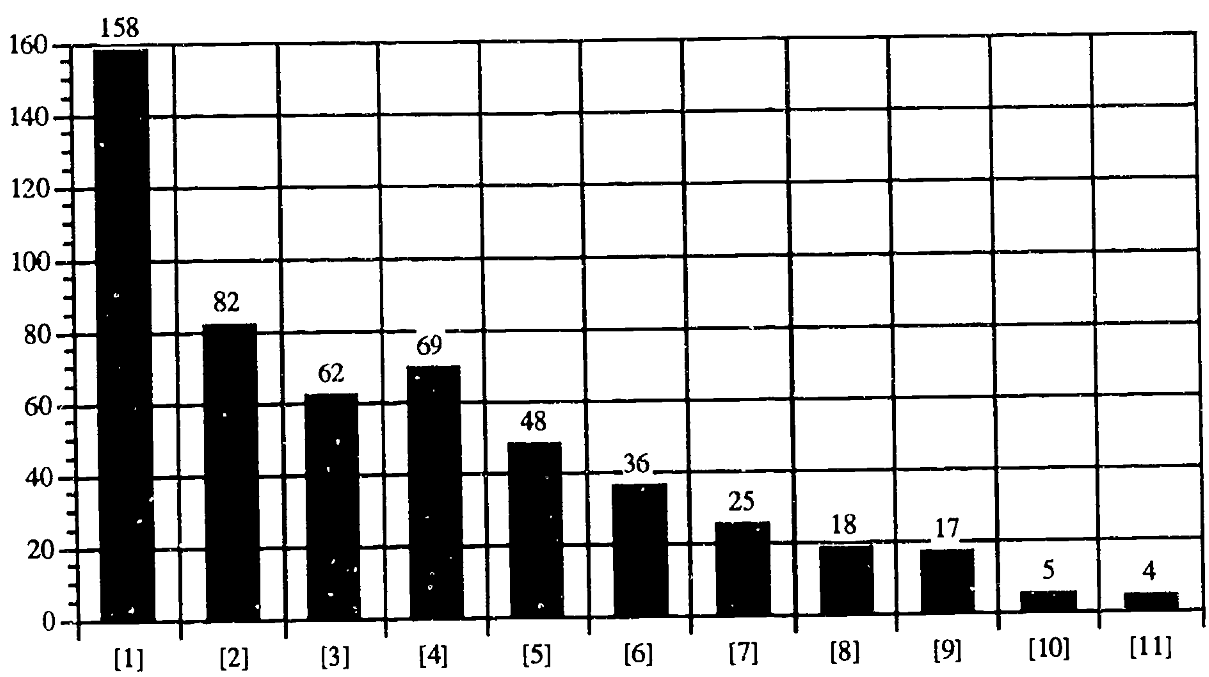
Aging Systems



Effectively Coping With Limited Resources



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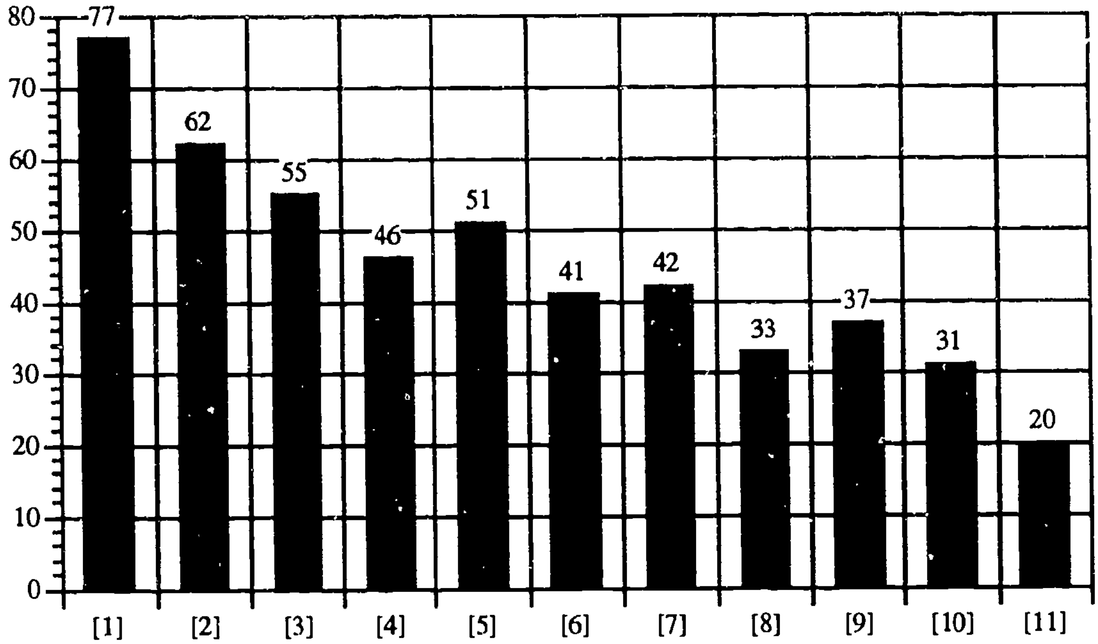
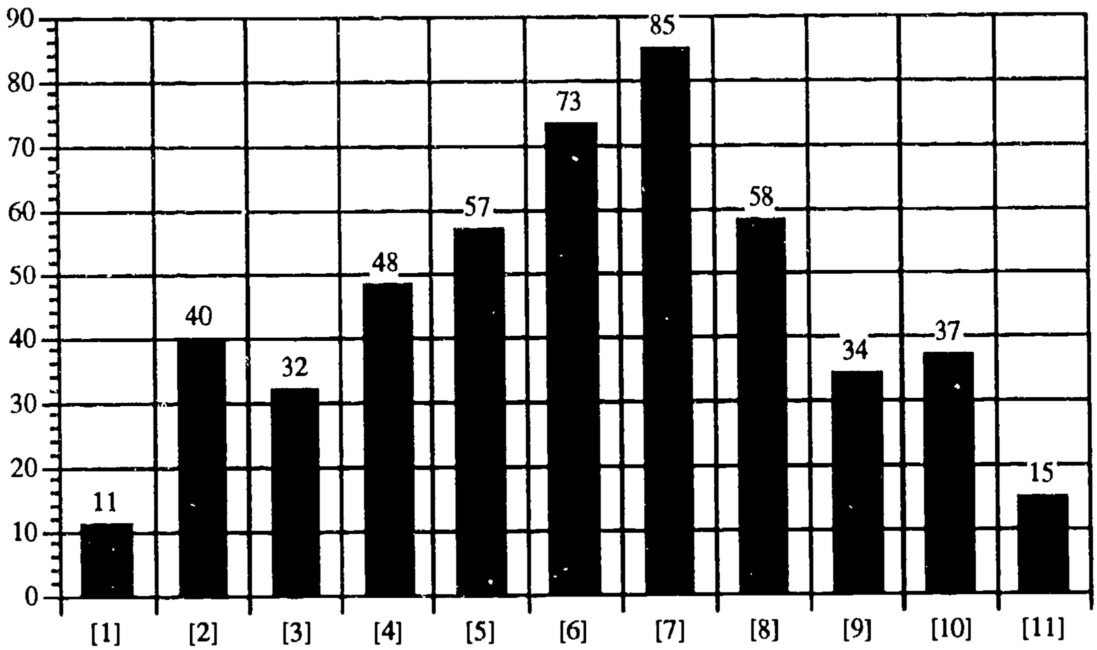
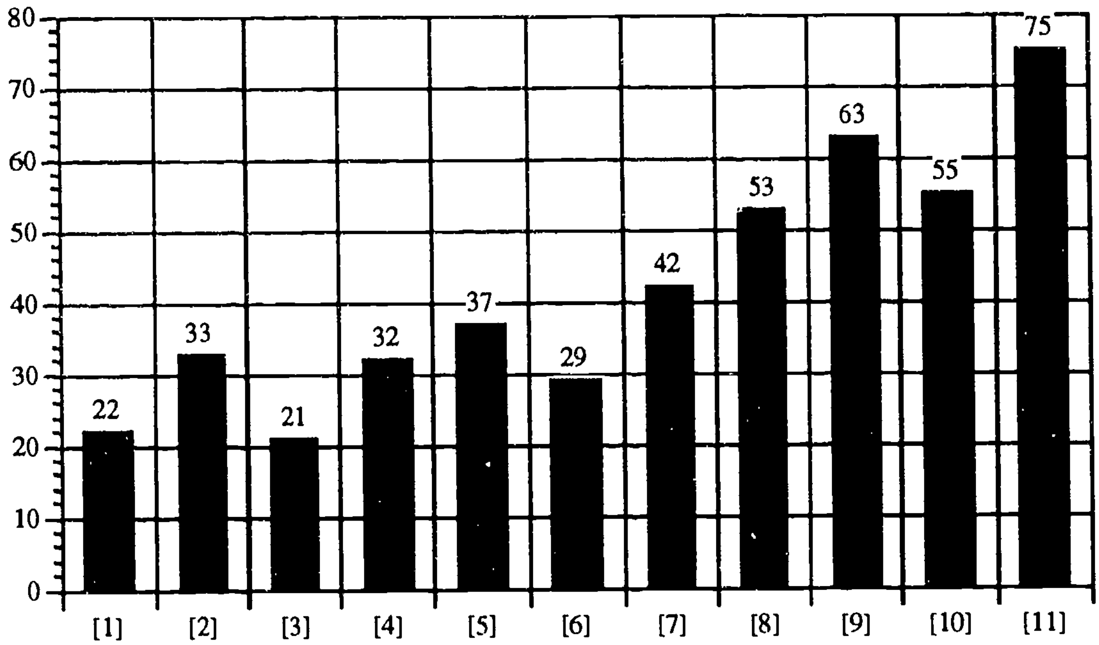
Developing an IS Strategic Plan



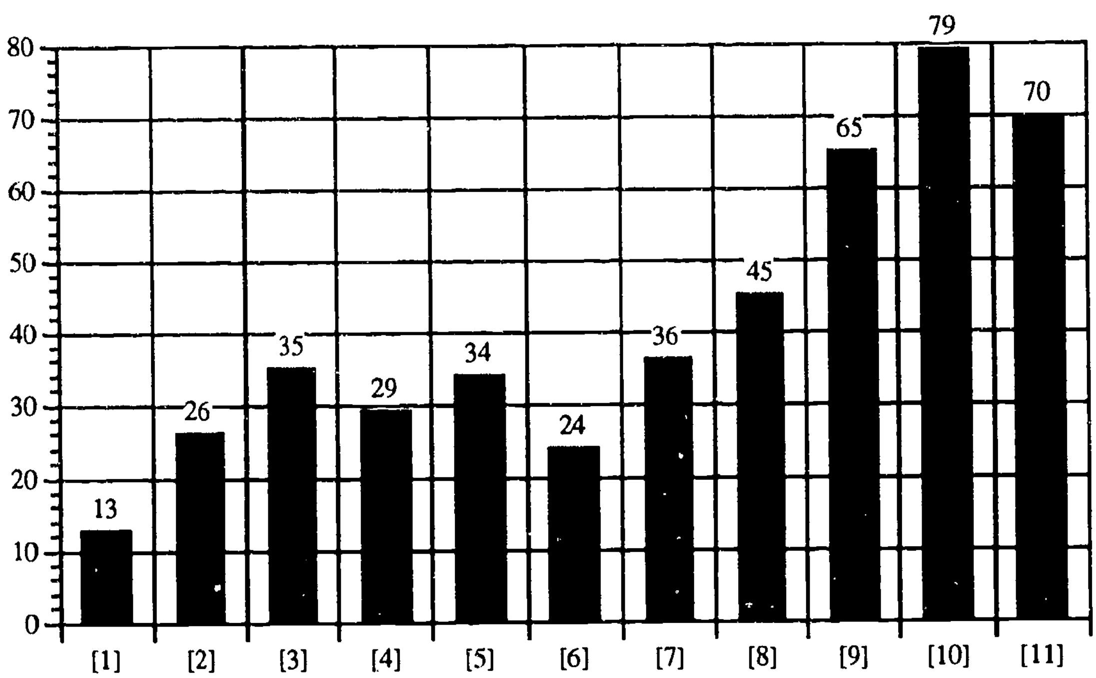
Quality Issues



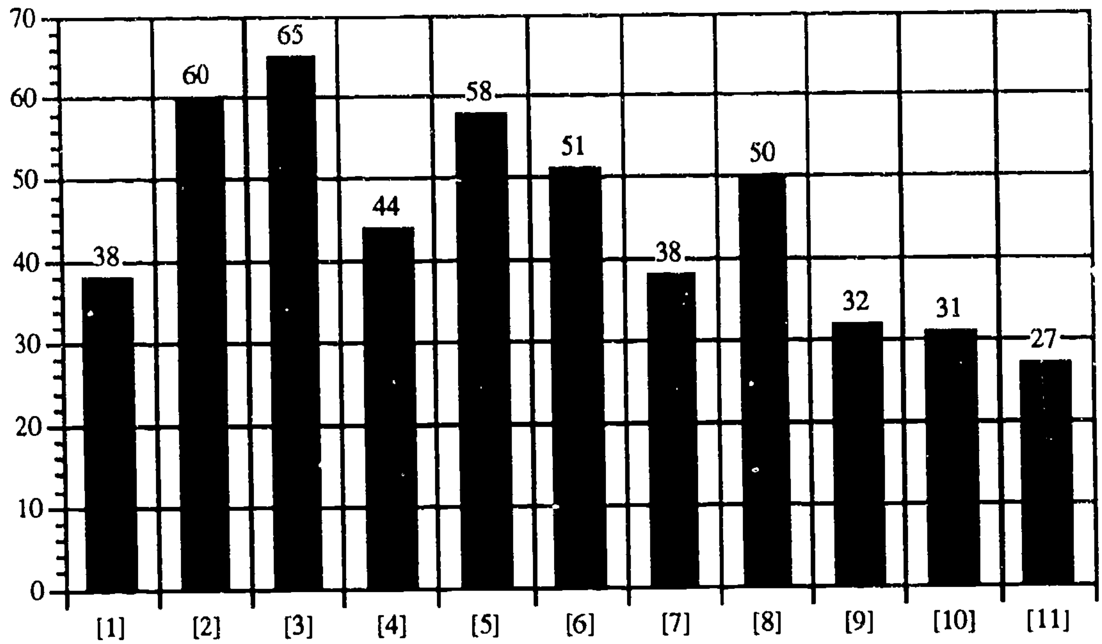
Justifying the Value of IS



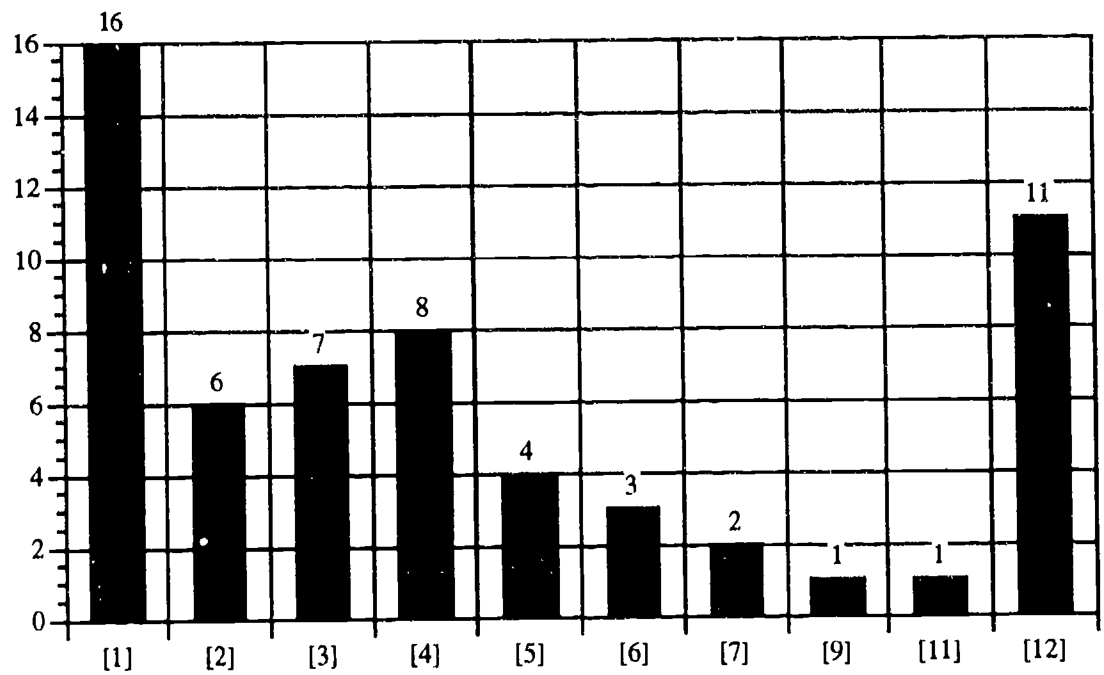
Downsizing



Client/Server



Other



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Other Responses and Their Rank (Sorted Alphabetically)

Rank	Response
4	Access to workstations for students & employees
1	Admin vs. Academic computing (% spent on each)
1	Align IS/IT with Business
2	Alliances with other agencies & Institutions
4	Burnout
1	Business Process Re-engineering
1	Campus backbone
2	Campus Control
1	Co-operative Acquisition of Systems with other Institutions.
2	Computing in the Curriculum
7	CWIS
6	Data Administration
4	Dealing with quick development of Technology
5	Determining the Effective Size of Computing Hardware
6	Development Environment
12	Development Backlog
4	Disaster Planning
6	Distance Learning
12	Distributed Environment
	EDI
3	Educating Customers/Users to think globally about systems
1	Efforts of Legislation/ Lack of Funding
1	End User Computing
9	End User Support
2	Executive Info. Systems
4	Exploiting technology in the Classroom
3	Faculty Development & Training
1	Gaining full support of faculty & staff
2	Implement Software Platform
3	Increasing productivity; Keeping up with Technology changes.
12	Industry Shakeout and Rational Business Relationship
1	Information Access
2	Information Access
5	Integration
3	Integration into Educational Program
3	Integration of Images into Database
12	Involving Sr. Administration in Futures
1	IT in the classroom
6	LAN/Wan & integrated comm.
1	Modify college procedures to maximize benefits of technology
1	Multimedia
4	Multimedia
12	Organizational Structures
4	Outsourcing
12	Pay
1	PC-Unix-Mainframe Connectivity & Databases
12	Print/Doc. Distribution
12	Processor and Operating Systems Platform
4	Productivity of Analysts/Programmers
12	Programmer/Analyst Productivity Tools

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Other Responses and Their Rank (Continued)

Rank	Response
5	Proliferation of Micros
1	Seeking Base Budget Commitment
8	Software Updates
7	Staff Reorganization to meet user needs
5	Support for Multimedia
12	Support Personnel
12	Technology use in Learning (Multimedia)
3	Telecommunications
1	The intersections of teaching and learning with information
5	TQM
4	Use of Technology in Teaching
2	User Based Systems
1	User Training
3	viruses

CUMREC
BAYLOR UNIVERSITY '93
San Antonio

INFORMATION TECHNOLOGY: The Revolution Continues

STRATEGIC PLANNING & MANAGEMENT

W1-6

Instructional Effectiveness Support from On-Line Administrative Systems

John C. Biddle
University of Louisville

38th Annual
College and University
Computer Users Conference

Hosted by Baylor University
in San Antonio

May 9-12, 1993

452

Instructional Effectiveness Support from On-Line Administrative Systems

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I. Introduction

Collecting and processing data about and providing information on all facets of the institution is what administrative computing is all about. From its meager beginnings in the financial area, in most institutions, administrative computing has expanded steadily. Today it would be very difficult, if not impossible, for an institution to function long without these automated systems. In the main, the information produced from these systems has been distributed periodically to the appropriate consumer in paper or microfiche form. With the availability of inexpensive terminal equipment and telecommunication networks, most institutions have purchased or developed on-line access systems that provide enquiry and/or update capabilities to these administrative systems. Until recently, this capability was reserved exclusively for the administrative offices in almost all institutions. While providing the on-line access for themselves, the administrative offices were very reluctant to offer the same service to the academic offices. They were even more concerned about offering the service to faculty, staff, and students.

In a research study conducted in 1990-91(Biddle, 1992), I queried faculty around the world about their perceived on-line requirements for several administrative systems(referred throughout this report as the *faculty needs study*). As an extension of that study, I have now queried the administrative offices responsible for these systems to see if they are now offering or plan to offer on-line access to faculty. The appendix contains a summary table of the responses to the various questions.

II. The Study

In an attempt to discover how the institutions are responding to the requests for faculty access to the on-line administrative systems, I conducted a second national survey. The study was performed in a manner similar to the original 1991 *faculty needs study*. An 18 item questionnaire (see appendix) was transmitted electronically to several discussion groups on BITNET and INTERNET.

In place of the Likert scale used in the *faculty needs study,* respondents were requested to indicate the availability of the items as currently available, available within 6 months, available in 6 to 12 months, available in 1 to 2 years, thinking about doing it but not yet scheduled, and will not provide access on-line. Early on in the replies, one institution indicated they needed a category for "*had not considered the possibility*". This category was immediately added to the questionnaire for all future transmittals. No attempt was made to contact those already submitting responses to ask for an adjustment given this new category. Another category that appeared was "*don't understand what you mean*". The questionnaire was not revised to include this category. All data were tallied as they were received unless the individual requested specific clarification. In those cases, a message explaining what was meant by the category was returned to the requester and their data were not recorded until a new response was received.

While most of the items in the questionnaire were analogous to those in the *faculty needs study*, several items were new. These new items were taken from the list of "extra" items provided by the respondents to the *faculty needs study*. It is for this reason that no statistical correlations are being made between the two surveys.

Those institutions that do provide on-line access to administrative systems data do so in several different manners. One procedure is to incorporate the access into the campus-wide information system (CWIS). The most definitive information on CWIS can be found in an article by Judy Hallman (1992). Jones (1992) reports on an implementation of CWIS at Appalachian State University. Another procedure is to simply expand the number of users by permitting access on an individual basis. The process is to grant access to the systems to anyone who has received the appropriate security clearances.

III. Analysis of the Data

Even though a category of "*had not considered the possibility*" was added to the questionnaire, it was not included in the final analysis. Data are reported as percentages of responses to a given item. Where the data provided interesting results, I have recalculated the percentages to include the "*had not considered*" category. I have clearly indicated when this occurs. If not specifically identified otherwise, all calculations do not include this category. The data were further reduced by combining all categories where the item was either already available or scheduled for production. This then created only three categories. The charts that use all five categories will use the following identifying format. a = currently available, b = in 6 months, c = in 12 months, d = in 24 months, e= have yet to schedule, and f = will not provide. The charts that use the combined format will use: 1 = available or scheduled, 2 = not scheduled, and 3 = will not provide. The bias of electronic mail responses only was not considered a factor in this study. This study is concerned only with responses from CUMREC-L, CWIS-L, CAUSEASM, and ADVISE-L subscriber institutions.

A. Student Related Items (Figure 1)

Student progress toward a degree is called by various names. Some institutions call it degree audit while others call it academic progress (Singer, 1992). McCauley and King (1991) report as many as nine vendors are currently marketing software for progress toward a degree. It would appear that more institutions, providing this service, use the DARS software created by Jack Southard and his group at Miami University of Ohio[1] than any of the other packages. Another institution that has developed its own system and currently licenses it to others is Brigham Young University. A discussion of the development of this system can be found in Kramer and Rasband's (1992) article.

53% of the respondents indicated they have this system installed and available for faculty use. 6% indicated it would be ready in 6 months and 6% more indicated it would be ready for use within a year. In all, 74% either have the system available or plan to have it available. 13% are considering the possibility of providing the service but, as yet, have not set a target installation date. 13% stated they had no intention of providing access to an on-line degree audit system for faculty access. It was impossible to determine, from the responses, whether this meant they had no intention of installing a degree audit system or if they were not going to provide faculty access to it.

In the *faculty needs study*, electronic class rosters were an item that 85% of the faculty stated they needed. 70% of the institutions responding have heard this request and currently provide this

[1] For information about DARS (Degree Audit Reporting System), contact Jack Southard, Miami University of Ohio at his BITNET address: southard@miamiu.

service to their faculty. 18% are considering the possibility but do not have it on their implementation schedule. 6% will not provide the service to faculty and an additional 6% plan to have it ready for use within 24 months.

At the other end of the term, offering the ability to file final grades electronically from a faculty workstation is a possibility at only 11% of the responding institutions. An additional 4% should have the service ready by now. 15% plan to have electronic grade filing available to their faculty within 2 years while 30% stated they are considering the possibility of offering the service but as yet have not scheduled it for production. 41% have no plans to ever offer this service. Interestingly, when the "*had not considered*" is included 21% stated they had not considered the possibility yet.

Comparing electronic rosters and electronic grade filing, it is not surprising to note that all but one of the institutions offering electronic grade reporting also offer electronic class rosters. Of interest is the fact that 22% of those already providing electronic class rosters will also have electronic grade filing available in 2 years. Another 26% are considering the possibility of providing the service. A very interesting response was received from the 6% which stated they had no intention of providing on-line class rosters. 100% of them responded that they were thinking about offering electronic grade filing even though they had no intention of providing class rosters.

Providing the ability to inquire into the file of a student during the advising process was a relatively high priority among faculty with advising responsibilities. 41% of the institutions responding are currently providing this service to their faculty. 7% more will have it ready within a year and 19% in 2 years.

A more sophisticated system would provide the ability to change the demographic data in a student record. Such access obviously requires additional security and one might anticipate that fewer institutions would offer this service. That is in fact the case. Only 9% offer the ability to change student demographic data from a faculty workstation. 58% stated they had no intention of ever permitting changes to student demographic data from a faculty workstation. 9% indicated they possibly would allow this to happen in the future and 4% have it scheduled for completion.

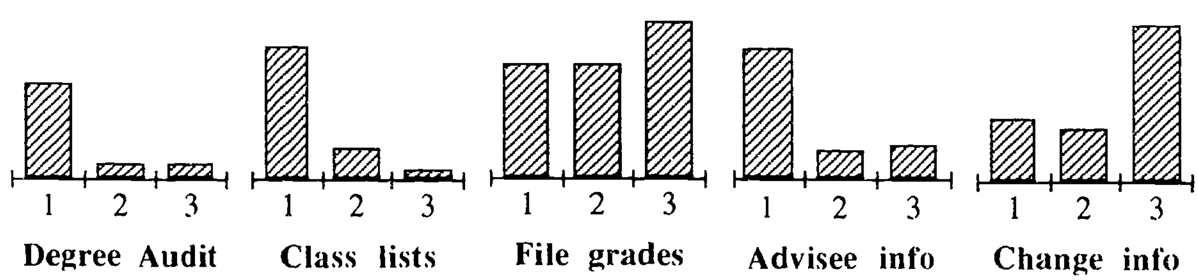

Figure 1

B. Financial Related Items (Figure 2)

Researchers with control over financial accounts have been asking for on-line ability to inquire into the status of the accounts, to initiate purchase requisitions and purchase orders, and to query the progress of purchase requisitions(PR) and purchase orders(PO). 54% of the responding institutions reported they provide inquiry capabilities for individual financial account holders. Rivkin and Hurley (1992) report that such a system has been succesfully implemented at Princeton

University. An additional 8% plan to have the service available within 2 years. Walsh and Holland (1992) provide insightful information concerning their current progress in implementing a very sophisticated user friendly system for Indiana University. 21% have the issue under consideration but not scheduled for production. 27% currently provide the ability to initiate a purchase requisition and 57% of this group also permit creation of a purchase order at the workstation. Interestingly enough of those that permit the initiation of both a purchase requisition and a purchase order only about three quarters will also let the individual monitor the progress of them through the system. Of the institutions that do permit on-line creation of a requisition, the same percentage permit monitoring the progress through the system, however the two groups are not composed of the same institutions.

When looking at the set of institutions that do not currently offer on-line access to the creation of a PR, 4% have it scheduled for completion in 6 months and 15% more in 2 years. Fewer plan to offer on-line PO generation. Offering query capability to the progress of either a PR or a PO seems to be more pervasive in the next 2 years as 21% of those not already offering this service plan to have it ready within that time.

27% of all institutions reporting are considering the option of on-line PR initiation outside the Purchasing Department. Of these 71% are also considering the possibility of permitting the initiating the PO. 25% of the institutions have the progress of PR/PO issue under consideration. 19% have no intention of providing on-line PR generation while 7% will not establish PR/PO inquiry. 42% stated they would not permit PO generation on-line outside of the Purchasing Department.

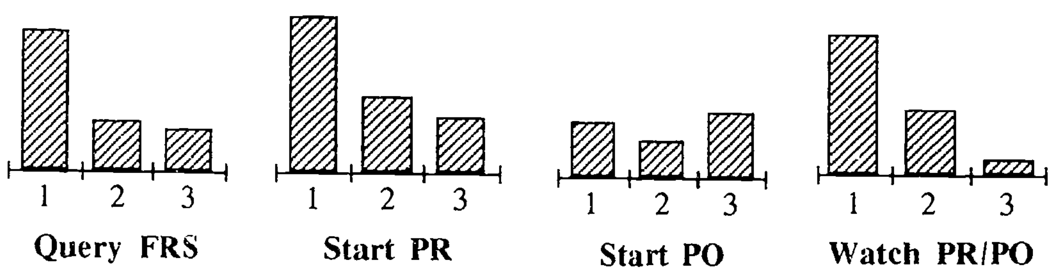

Figure 2

C. Grade books (Figure 3)

In addition to providing on-line class rosters, many faculty were interested in the possibility of an electronic grade book. While this was not spelled out in detail, most faculty wanted to be able to record grades on tests, quizzes, and homework and to have the system calculate at least percentages and possibly apply weights to various categories of recorded work. Some even wanted the system to create the letter grade from the data. 32% of the institutions already provide electronic grade books for the faculty. 10% will have it ready in 2 years and 41% have no intention of offering the service. Factoring in the "*had not considered*", the largest percentage (35%) have not considered the option.

One possibility here is to provide downloading of the class lists to the workstation and then providing the faculty with workstation software for the grade book. In my own situation, downloading of the class lists to my workstation is all I require (we are currently testing this concept). I would transfer the file to my Excel spreadsheet grade book where I have already created the weighting factors for each area (quizzes, homework, tests). I currently produce a

running grade for the class and a graph of the grade distribution. The final grades and the graph are printed and placed on display outside my office door almost as soon as the final tests are graded.

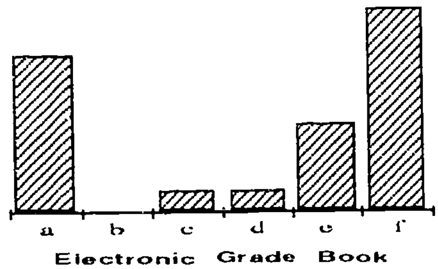

Figure 3

D. Personnel Related Items (Figure 4)

Permitting a person inquiry access into their personnel records has been adjudicated by the courts on several occasions. While the courts have not stated the access must be on-line, they have opened up almost all items in the personnel file for inspection by the individual. Permitting a person to look at their own personnel records on-line was something the faculty had an interest in having as well as the possibility of changing the demographic information.

Of those responding to this item in the questionnaire, 28% currently permit their employees to view their file on-line. Of the institutions that currently provide on-line access, 14% also allow on-line changes to the file, 57% *had not considered* the possibility of providing this service and the remaining 29% stated they had no intention of adding this capability.

4% of the institutions will add viewing of the files in 6 months, 12% stated they were thinking about the possibility and the remaining 48% will not offer the service. 76% of all institutions have no intention of ever permitting faculty to update their files on-line but 12% are currently looking at the prospects of offering the service. Again, when "*had not considered*" is factored in, a large percentage (26%) had not considered this service.

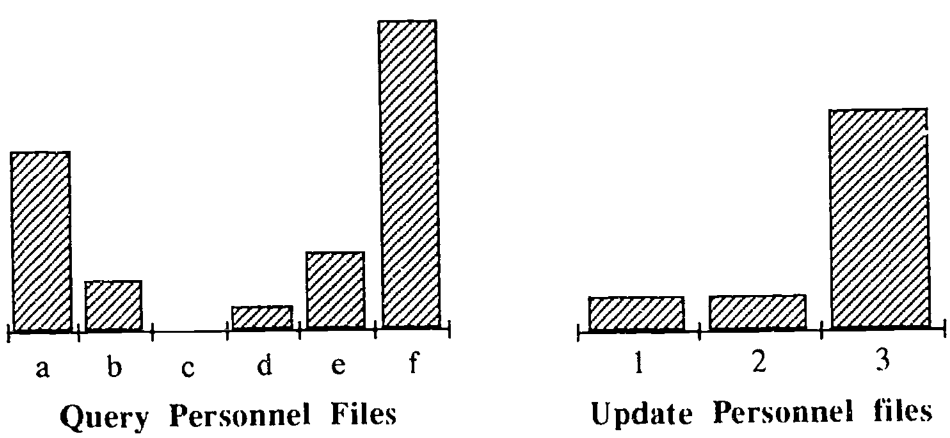

Figure 4

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E. Other On-line Systems (Figures 5 and 6)

Several areas of general interest to faculty were expressed as "extra" items in the *faculty needs study*. I selected 6 of the most often requested items to be included in this study. After looking at the results of this survey, I have had difficulty rationalizing why on-line access to the central library generated ssuch a high percentage response in the *faculty needs study* since 92% already have on-line library services available. 4% will have the library connected to the institution's network within a year. Only one institution indicated it has no intention of installing an on-line library service for its faculty.

In the area of general campus information, 43% reported they provide a campus news digest, 9% will have one ready in 6 months and 13% within two years. Less than 10% indicated they had no interest in offering a campus news digests on-line. The remaining 26% are considering the possibilities of putting up a news digest. Over half currently have an events calender available. 17% are working on a system and will have it in production mode within 2 years. The remainder of the institutions are either seriously considering the possibility of installing an events calendar or have not given it any consideration.

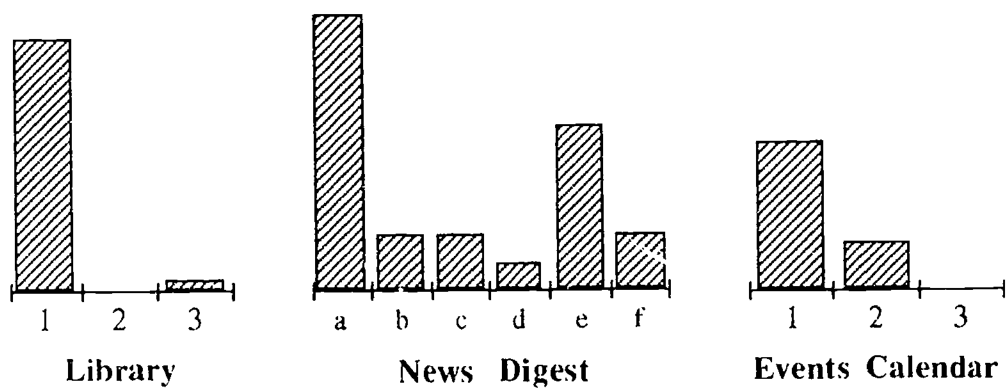

Figure 5

75% reported they had an on-line campus phone directory. An additional 4% are completing the system and will have it active within a year. 17% do not believe it is necessary.

The on-campus stores (supplies) catalog is an item that is most generally found to be out of date. It is also relatively expensive to continuously publish revisions as items are added or deleted and as prices fluctuate. Usually one copy is sent to each department. Experience has shown that the department copy sometimes becomes misplaced or is in use by someone else when it is needed. Additionally, the copy is only available in the department office when that office is open. This could be 9:30am - 4:45pm Monday - Friday. Many people, researchers in particular, work odd hours and require access to the supplies information at times when the office is closed. For those individuals, access to an on-line supplies (campus stores) catalog is a time and effort saver.

In response to this need only 35% of the institutions have installed an on-line stores catalog. 26% appear to understand the need but as yet have not placed the system on the workload list. The remaining 39% appear, by their response, to believe there is no need for this system. At present, no one is working on the installation of a system, they either have it installed, are considering doing so, or will not install one.

The final question on the survey had to do with electronic access to the schedule of classes from a faculty workstation. Having the ability to look at the schedule of classes was important to

faculty. No reason was given for this need but it is surmised that much of it came from faculty with advising responsibilities. It has been my experience that a paper schedule is easier to use while discussing a schedule with a student than having only 22-24 lines of an on-line schedule available at a time. However, if the status of each section (open/closed) is also included in the on-line system, then the system becomes more valuable especially during the late enrollment period.

In any case, 50% of the respondents are offering an on-line schedule. 3% will have one available within 12 months and 10% within 2 years. 20% have no intention of putting the schedule of classes on-line while a similar percentage (17%) have been discussing the possibility of adding this system to their work list.

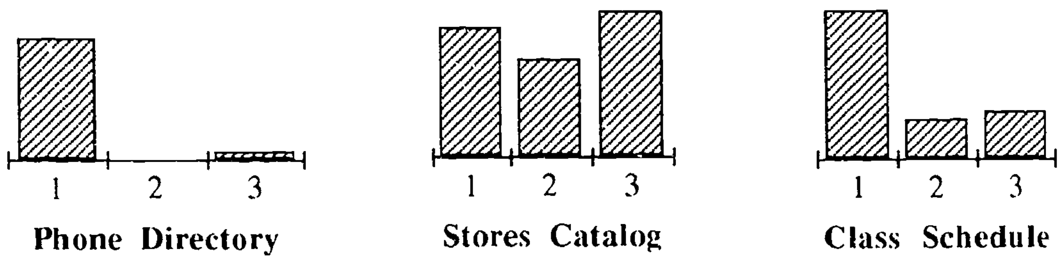

Figure 6

IV. Summary

One of the surprising results of this study was the number of institutions that reported they had not given formal consideration to the possibility of offering many of the on-line systems that were listed in the questionnaire. The percentages ran as high as 35% for the electronic grade book to 3% for transmittal of class lists to an instructor's workstation.

Of the institutions that had given consideration to a particular system, no institution reported that an events calendar would never be offered on-line and only one institution was never going to offer on-line access to the library system.

University officials appear to be listening to the request from faculty and researchers for access to the on-line administrative systems. Since the survey of faculty needs was initiated in 1990, many institutions appear to have reconsidered their policy of excluding faculty from access to many of the administrative systems. This is very vividly depicted in the figures that follow.

In the student related systems, the category that was listed most frequently was "currently available" except for filing grades and updating demographic information. Figure 7 graphically shows these relationships even after the data have been aggregated.

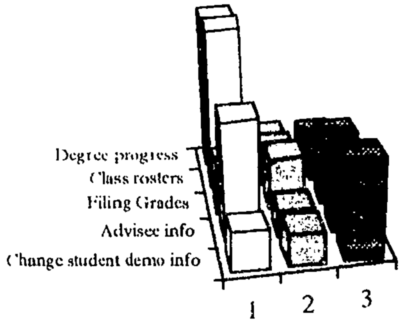

Figure 7

It is surmised that the lack of sufficient security and possibly a continuing, but unfounded, fear that the integrity of the data files would be broached by offering on-line up load of grades and on-line modification of demographic data are the reasons these two items show low current availability. It is the author's belief that many of the institutions which stated on-line demographic data updates would never be permitted are fearful of corruption of the data by the faculty. Some of the reporting institutions not only permit faculty to update these data but go so far as to permit the student to change the data.

Figure 8 shows the comparative results of the responses to the financial related questions. As with the student systems, the "currently available" category was selected most often from among the institutions where thought had been given to the systems.

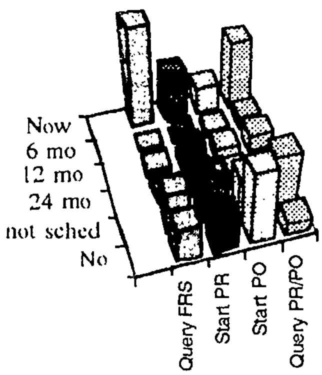

Figure 8

It is understandable that the initiation of a purchase order from a remote location by a person not in the purchasing department might meet with some resistance in many institutions. The act of initiating a purchase order may require the creation of a bidding process or may require sole source of the items from a preselected vendor. Faculty may not be aware of these facts and could cause embarrassment for the institution if the purchase order was issued incorrectly. This could be as severe as legal action by one or more vendors if contractual or statutory agreements were

violated.(Rivkin and Hurley, 1992) On the other hand, the on-line initiation of a purchase order does not preclude its monitoring and editing by any number of parties prior to its release to the vendor. Institutions might find cost savings in time and personnel if the initiation of the purchase order were permitted from a remote location given that electronic signature approvals were required at appropriate stages of the process.

Some financial systems are constructed so that the purchase order is a natural outcome of the purchase requisition and is automatically generated from the purchase requisition information. In these instances there would never be a need to offer on-line purchase orders.(Rivkin and Hurley, 1992)

Institutions do not show the same progress toward providing on-line access or update to their personnel systems as they do to their student systems. When the access and update responses to the student and personnel systems are compared graphically, this difference is quite apparent. (figure 9).

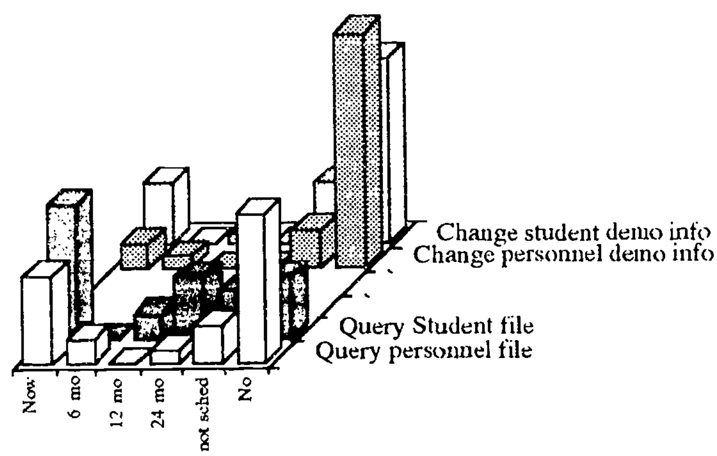

Figure 9

V. Conclusion

Institutions responding to this questionnaire appear, for the most part to be providing, getting ready to, or planning to offer on-line access for faculty to most of the systems listed. More consideration needs to be given to such items as electronic filing of grades and the ability to query and update personnel records by the faculty member.

Additional studies in this area might:

1. explore the reasons why some institutions do not plan to offer on-line access to faculty to certain systems.

2. evaluate the same questionnaire with institutions not subscribing to the discussion groups this questionnaire was distributed to.

3. conduct an in depth analysis of a selected few institutions that are the leaders in providing on-line access to their systems as to why they decided to provide the service.

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Appendices

Appendix 1 The questionnaire

The following is a list of potential items that could be placed on-line for access by academic faculty where the proper "need to know" exists and data item security is in place. Please respond by placing the requested letter after the item and returning your response directly to me to keep the discussion group traffic down. If you are not the person to respond, please forward this note to some one who can respond. My address is jcbidd01 @ ulkyvm (BITNET) or jcbidd01 @ ulkyvm.louisville.edu (INTERNET).

A = installed and available
I = installing within the next 6 months
P = planning to install in 6 - 12 months
F = planning to install in 1 - 2 years
T = thinking about installing but no plan yet
N = will not install

1. Students' progress toward a degree information
2. Class rosters
3. Electronic filing of course grades
4. Assigned advisee information
5. Ability to change student demographic information
6. Ability to query financial accounts of research grants
7. Ability to initiate a purchase request on-line
8. Ability to initiate a purchase order on-line
9. Ability to query the progress of a purchase request/order
10. Electronic grade book
11. Access to library information system from faculty office
12. Campus new digest
13. Campus events calendar
14. Campus phone directory
15. Campus stores catalog
16. Query and update master schedule of classes
17. Ability to query personnel file
18. Ability to update demographic data elements in personnel file

Thank you for you time in completing this survey. The results will be most helpful and useful to you colleagues.

Cordially,
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Appendix 2 Chart of percentages without "*had not considered*".

	Now	6 mo	12 mo	24 mo	Available/ Scheduled	Not scheduled	No
Degree progress	53%	6%	6%	9%	74%	13%	13%
Class rosters	70%	0%	0%	6%	76%	18%	6%
Filing Grades	11%	4%	0%	15%	30%	30%	41%
Advisee info	41%	0%	7%	19%	67%	15%	19%
Change student demo info	19%	0%	4%	0%	23%	19%	58%
Query FRS	54%	0%	4%	4%	62%	21%	18%
Start PR	27%	4%	12%	12%	55%	27%	19%
Start PO	15%	4%	8%	8%	35%	23%	42%
Query PR/PO	37%	7%	11%	7%	62%	30%	7%
Grade book	32%	0%	5%	5%	42%	18%	41%
Library system	92%	0%	4%	0%	96%	0%	4%
News digest	43%	9%	9%	4%	65%	26%	9%
Events calander	59%	7%	7%	3%	76%	24%	0%
Phone directory	75%	7%	7%	4%	93%	0%	7%
Stores catalog	35%	0%	0%	0%	35%	26%	39%
Query sched of Classes	50%	0%	3%	10%	63%	17%	20%
Query personnel file	28%	8%	0%	4%	40%	12%	48%
Update personnel demo info	8%	4%	0%	0%	12%	12%	76%

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INFORMATION TECHNOLOGY: The Revolution Continues

ALTERNATE PAPER

Confessions of a Project Manager

Jim K. Gorham
Baylor University

38th Annual
College and University
Computer Users Conference

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in San Antonio

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CONFESSIONS OF A PROJECT MANAGER

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Fall 1986 arena registration was in full swing, on about the fourth out of five scheduled days. Russell Gym was full of frustrated students who had waited until the last minute to be admitted, advised, and registered; yes, the lines were long! Most students had not yet submitted financial aid applications, much less thought about how they would pay their registration bills. Classes were scarcer than hen's teeth and I had had it up to here with problems. Student bills were still being calculated manually and were posted to ledger cards. Baylor did however have an on-line class registration system that did a good job of keeping up with schedules, but would only interface with other systems once a semester in a batch operation.

Yes, I was in charge. No one hesitated to ask me any question, any number of times. Very politely they would be answered . . . one by one. During the height of the excitement, none other than the Vice President for Information Systems came up to me, put his hand on my shoulder and said, "I would like for you to be the project manager for the implementation of our new student information system." A thousand thoughts raced through my head: (How could I refuse? I couldn't turn down a Vice Presidential request! I could delegate this wonderful registration job to my able-bodied assistant. Brother, did the VP know when to catch me when I was most vulnerable! When do I start? Now? No, better wait and get registration wrapped up.)

That was how I became the Project Manager for the implementation of Baylor's new Student Information System. In the last six years, after the successful completion of SIS, I have been Project Manager for two additional software systems, a large financial system and a loan management system. Needless to say, I am very thankful for the experiences and desire to share a few ideas I have learned along the way.

PROJECT MANAGER

Ideally the position of Project Manager should be full time. If not, the Project Manager should be relieved of as many other responsibilities as possible. No implementation can run any faster than the slowest decision or project can be completed. The cost of time must be considered when this important decision is made. How quickly do you want the system to be implemented? Is the old main-frame computer about to go? If you are installing new hardware as well, is the cost of annual maintenance on the old computer more than the cost of allowing the Project Manager to be full time?

PROJECT TEAM

Like the Project Manager, the Project Team should be comprised of competent personnel dedicated to the successful implementation of the system and be representative of every vital area affected by the software. Representatives of the computer center are as vital as any other area and must be included. Who else can say you can't get a computer to do a double back flip when it is obvious to the user that is what is needed?

Each Team Member should:

1. Have the trust and support of his/her supervisors
2. Be knowledgeable of his/her respective areas
3. Be able to think independently
4. Be willing to work hard and willing to give extra hours
5. Be able to communicate well
6. Be bold enough to defend one's own area's interests
7. Be open to compromise with others
8. Know when to do either 6 or 7 above.

At the first meeting the Project Team should establish a weekly meeting day and time which must have priority over all other meetings. Meeting location may change to accommodate members as necessary. A change of scenery may trigger a "better idea."

During the meeting:

° Have an Agenda. — An unorganized meeting can have too many tangents, although you should leave room for miscellaneous items at the end.

° Keep Minutes. — Someone (consider the Project Manager) should record minutes of every meeting to document decisions and to be able to report on the progress or the lack there of to a responsible party.

° Be under Authority — The Project Team must report to a person in authority who will keep them accountable for their actions and who can run interference when necessary.

° Make Assignments — Each member will be responsible for decisions in his/her own area but should be assigned additional duties as necessary that do not fall into anyone's specific area. There will be plenty of these to go around!

° Maintain a Calendar — Early in the project, specific goals and objectives should be established with realistic dates of accomplishment. Create a calendar showing each goal and how it relates to the others. Visual schedules help to emphasize the importance of

each step by showing that the failure to meet one goal will have a major impact on the entire project. (Use an erasable marker since reality seldom mimics plans .)

- Prepare Project List

  Most software packages come with a conversion or installation list of projects. This is a great beginning, but schools often want additional enhancements. Prepare a prioritized list of each enhancement, report, interface or special programing request that includes a brief description and estimated time to complete. A comments/status column will keep everyone informed. Once established, the priority and comments will constantly change. Also, keep all completed projects on the report. The Project Team will gain a real sense of accomplishment when reviewing the list after several months. Don't view the list as an insurmountable task, but recognize it as a challenge or even as Job Security!

- Ask "Why?"

  Every school has rules for accomplishing each task. When questioned, the answer many times is, "That's the way we have always done it." or "It has served us for 20 years, there is no need to change now."-- Don't buy it! For each and every decision there should be a rational reason. No, the above two quotes are not rational! What will happen if it is done another way, or why even keep doing it? What is the end result? Is there some intermediate benefit? Question everything like a five year old. Be able to defend decisions with the determination of a high school senior and the wisdom of a grandfather.

- Make the Decision

  Someone has to decide everything. Many questions are simple and easy to answer. Don't be afraid to make decisions that are really inconsequential. Confession time! When we converted marital status values from our old system to the Student Information System, we only converted (M)arried and (S)ingle. (D)ivorced and (W)idowed were converted to single. Team Members agreed that the reason a person is single is not relevant to the university. The decision was made by the Project Team without anyone else's approval. Remember: "It is always easier to get forgiveness than permission."

- Be Gracious

  Have an open attitude of compromise. Try to visualize the needs of the other offices. There is always a solution. Some of the best suggestions

came from Team Members who were not involved directly with a conflict and could step back and suggest an easy solution.

INTERNAL PROCEDURES

Each Team Member should direct the review of all internal procedures within his/her respective area. The Team Member should keep a critical eye for the reason of each procedure and how it will be accomplished in the new system. This review should include the flow of information through each area. Again, ask why do we do it by steps 1, 2, 3, ... ? Would it be more efficient to do 1, 3, 5, 2, 6 and skip 4? Can the same information be obtained elsewhere or does anyone still need this report? New internal procedures should be written with a good understanding of the new system as well as input from co-workers. Internal procedures should be reviewed on a regular basis.

INTERFACES

One major consideration will be interfaces. What other systems will feed information into the new system or what other system will be expecting information from the new system? Who will write the interfaces? Can it be handled in house or will you need to contract it out to a software vendor? Who will coordinate what information is needed to be transferred between systems?

REPORTS

Make a listing of all reports produced by the current system. If done in January, the annual federal reports will be listed. If done in July, you will wish you had done the listing in January. It doesn't matter when it is done, a group of reports will not be remembered. However, every effort should be made to prepare the most complete list possible. Now see what reports the new system will prepare for you. How many reports will the new system prepare? How important is each report to the university? From this research prepare the listing of reports that must be written, converted or modified.

TEST, TRAINING, AND PRODUCTION

How much space will the computer have for files? Hopefully there will be enough room to have three systems -- Test, Training, and Production. The Test system will allow experimenting and testing new programs, modifications, fixes and "great ideas" without compromising the integrity of Production's "real" data. This will be the programmer's playground. Training will mimic production except for the data. The Training system will provide a place for all training of the Project team first and later the staff. Training is where mistakes can be made and no one will get upset. Students of the system can relax knowing "it doesn't really matter." Production is where it really matters. This is the live data. This is the "real" world! Production must balance and be reconciled. Production is LIFE!

Some schools will not have the luxury of having three independent systems. As a minimum, a modified Test version and a full Production system are required.

Fight for as much as you can, but realize this is another area of possible compromise.

Use the Test system to try as many scenarios as possible when testing the initial system, any modifications or "fixes". Think of every scenario possible, because if you don't, someone else will with the production data and require the programmer's midnight oil to burn once again!

SYSTEM TRAINING

There will be several rounds of training. The first training will normally be by the software vendor. Usually the training is presented by module or specialty area. It is most important that the entire Project Team be included in every training session. Most systems are so interrelated that a comprehensive understanding of the system is the only way the Project Team will be able to intelligently discuss any conflict. In addition to Project Team members, primary users should be included in the specific training seminars. This will provide a good forum for input from other sources. Additional questions may be raised and future problems avoided.

After the formal training by the software vendor, training materials should be prepared for use by all end-users. Provided materials can often be modified to reflect university procedures. By developing your own materials, generalized assumptions can be removed and specific examples inserted. End users should be trained in a timely manner without rushing or skimming any important topics. Materials with plenty of illustrations and references can provide the same comfort as a teddy bear.

SECURITY

Security is a major issue at many institutions. The Project Team should be aware of the abilities and limitations of the delivered security system. Knowledge of the exact mechanics is not as important as what the system can and cannot do. Each member should review the security needs within his/her own area and recommend how it can best be served.

Another big question is how much access will one area obtain in another area's domain? Some higher authority will ultimately have to decide who can see what in many cases. The need to know must be answered appropriately.

REPORT WRITER

Many systems have a form of report writer. If available, one person in each area should become the resident expert. He/She will be responsible for the reports for that area. Having the ability to perform such tasks locally, not only frees the programmer's time, but allows the user access to the information desired, not necessarily requested -- too often this is not the same thing. More information can be extrapolated faster and in a more meaningful format. A good report writer can pay for itself in a very few months with the savings in not having to rely on a programmer's time (salary). The alternative is to wait weeks for your turn to have a report prepared by the computer center staff.

CONCLUSION

When does a Project Manager stop being the project manager? In reality no one can pinpoint an exact time. Once the software is in production and the system is running, there will still be several unresolved items. The computer system will be in a constant state of evolution. The Project Manager's new responsibilities will take precedence over former obligations. However, in the minds of the users, a good Project Manager will always be the resident expert on the "system". Phone calls will continue long after the Project Manager has gone on to "bigger and better" things.

The Project Manager must gently wean the users of calling first with every question and have them to begin researching the answers themselves. For the benefit of the institution, a quasi-project team should remain organized to resolve conflicts that will continue to raise their ugly heads. Most software packages are so integrated that a decision in one area will most likely have an effect on another area and it must be resolved to the benefit of all parties concerned. The need for coordination will never cease as long as we rely on integrated software. Questions will continue for ever and ever. Amen.

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INFORMATION TECHNOLOGY: The Revolution Continues

ALTERNATE PAPER

Parking a "Parking Management System" in a Distributed Environment

Hilda Mo
Bill Gryba
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Parking a "Parking Management System" in a Distributed Environment

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General Information

The University of Alberta is one of Canada's largest universities. Student annual enrolment stai.. at close to 30,000, academic staff number almost 2,200, and full time support staff total more than 3,000. Parking Services is a division in the department of Physical Plant. It currently provides services for 13 lots and 5 parkades, with approximately 17,000 permits and 350 on the waiting list. The number of tickets processed annually is well over 75,000.

There has been much interest expressed in distributed computing in the information systems industry. Many questions have been received on ticketing hand-held units and mainframe interfaces with parking systems, through CUMREC correspondence. This paper shares our experiences in implementing a Parking application with many functions and interfaces in a new and diversified distributed environment.

Project Background

The old parking system was first developed in 1974 using IMS data base technology and upgraded in 1978. Data entry was via a video 370 batch processing system, and on-line inquiry capabilities were restricted. The functions of Parking Services have expanded extensively in the last *fifteen* years, as new parking lots have been added along with new card access systems. The number of transactions has increased significantly due to increased numbers of students, parking violators, permit variations, zone preference changes, and increased interfacing with other University systems.

The objective of the new system was to be an integrated application, capable of interfacing with other systems such as Comptroller's financial system, payroll system, student record system, and hand-held ticketing units. It had to be a multi-user system so that the parking operations network could be provided with the most up-to-date parking information. It would also provide essential information for the future developments of the University facility management and financial systems.

Evaluation of Re-development Alternatives

When evaluating the redevelopment alternatives, it was difficult to reach a conclusive decision. Like many information systems analysts and management today, we were facing the dilemma of choosing to develop in the micro computer environment vs the mainframe environment. The options were:

1. Purchase vendor software with minimum modifications
2. Upgrade the existing IMS Parking System
3. Undertake new system development on the mainframe using IMS
4. Develop a new micro system jointly with central computing, Physical Plant and Parking Services as a central computing supported product
5. Develop a new micro system in-house by Physical Plant

The central computing department, Computing and Network Services (CNS), was going through extensive organization changes and a strategic planning process at the same time. The emerging technological infrastructure of *distributing computing* was a mandate to be considered for all system development. One component of the CNS Mission Statement was that "CNS must create the necessary computer and human communication framework to provide an integrated distributed computing environment which ensures interoperability and appropriate exploitation of hardware, software, and computing knowledge."[1]

After deliberation and an extensive decision analysis process, the

[1] "Networking Computers and People on Campus and Beyond," Strategic Plan for Computing and Network Services, February 1992, p. 6.

selection committee decided that going the route of Option 4 (Develop a new micro system as a central computing supported product,) to be in line with the University's future computing direction.

Project Development

The project was developed through the normal system development life cycle - Objectives, Business and Design Specifications, and Construction. The construction period was from January 1992 to November 1992 (10 month period). The development team was responsible for the complete system development, hardware purchases, software and new release upgrade, LAN set-up and network administration. The team consisted of one to four system analysts (depending on the development period) from CNS, one analyst from Physical Plant, and the staff from Parking Services. Management from the three areas participated in monthly status reviews.

The operating environment that was chosen before the project development and later reaffirmed as the best development environment at the time, was OS/2 with Extended Services (Data Base Manager, Query Manager), Ethernet network with OS/2 Lan Server. The development tools used were Microfocus COBOL Workbench and Graphic User Interface (GUI) Dialog for screen development.

The proposed local area network (LAN) configuration was one server with five workstations. A server and three workstations were initially tested and set up in CNS before moving to Parking. Currently the LAN has expanded to six workstations and two printers.

New System Functions

The new Parking Data Base is a relational data base, consisting of 17 main tables[2], 25 look up tables and three system generated association tables. The automated system interfaces built into the system are very

[2] The main tables are: Customer, Active Payroll and Student Name, Licence, Licence Customer Reference, Lot Allocation, Lot Inventory, Number Control, Payment, Permit, Permit Payment, Permit Rate, Shift Totals, Transaction Logging, Violation, Violation Payment, Violation Rate, and Waiting List.

extensive. File transfers upload to the mainframe from micro and download from micro to hand-held units and vice versa. Due to the mainframe IMS data base limitation and the university wide distributed environment not yet achieved, most of the data transfer is done via 3270 emulation. The automated interfaces have improved the administrative process significantly. The built-in interfaces include:

- Payroll deductions (permit and ticket payments, one-time and recurring) TO payroll
- Student encumbrances/disencumbrances TO student records
- Licence number TO Provincial Motor Vehicle Branch (MVB) for addresses
- Financial transactions TO Physical Plant Billing System
- Hot lists TO hand-held ticket writers (Clancy units)
- Name and Address FROM payroll and student records for effective permit and ticket notices mailing
- Name and Address FROM MVB for up-to-date registered owner information and name matching
- Tickets FROM hand-held units

The outstanding features provided with the micro operating environment allow great improvement to the on-line/batch development, more than initially anticipated, such as:

- Powerful screen presentation with windowing, pull-down menu, push button, and multi-tasking capabilities (see sample screens in Appendix A)
- Easy to develop and maintain screen/report layout
- Ease of user control and maintenance of the on-line menu and look up table to reduce future system maintenance
- Flexible searching and display by index retrieval, powerful customer searching (by name, payroll ID, student ID, permit, licence, violations) to determine permit eligibility
- Improved batch runs with on-line parameter editing
- Efficient name matching and connecting disconnected licences
- Variable length and horizontal scrolling of remark fields

- Dynamic file name opening and closing for manageable data logging and creation of small print files
- Powerful and flexible user generated reports from OS/2 Extended Services Query Manager. The simplified Query Manager update capability has eliminated the need of data base restore from backup due to job submission errors

The permit application process allows more flexibility for processing applications from staff, students, visitors and special guests. Its features enable Parking Services to:

- Accommodate annual, seasonal and casual permit applications for staff, students and visitors
- Provide management of waiting list, zone preference and priority
- Specify renewal processes selectively by customer type
- Provide an effective and multi-functions permit rate table
- Incorporate a number of optional steps such as customer summary, group licence query, add/renew/update permit, add/update/refund payment into the Permit Application process.

The parking violation processes received the most significant improvements in record keeping, printing notices and payment processes. New features include:

- Facilitate the upload of hot list from the Parking System to hand-held units and download of violation from hand-held units to the Parking system (this was the greatest time saving in data entry and corrections)
- Transfer effectively and timely student encumbrances/ disencumbrances to the student record system, complete with current owed amount
- Automate accumulation of violation amount and totals at customer and licence levels
- Provide aging of violations, tow list and encumbrance withhold control in table by customer type

- Use multiple payment receipts with a future interface to cash registers
- Automate appeals and improve appeal process results, keeping all original data recorded for tracking
- Use enhanced messages on violation notices, including appeal acknowledgment and decisions

Parking lot management is a new feature to efficiently manage limited parking space and provide information on available space readily and effectively for annual and casual permit parking.

- Able to schedule or reserve space for special visitors, maintenance, etc.
- Manage in and out temporary permits so that space can be used efficiently
- Plan to interface with kiosks (field attendants) in the future for up-to-date space availability information and message sending

The Financial Management is automated with selective financial transactions to the Physical Plant billing system (University departments and General Ledger). Future development will address the complete financial functions to include cash drawer interface, credit cards, ledger, etc.

Major Difficulties

There were difficulties in implementing this project; some were expected, and some just evolved. It was an adventure using the new tools and the LAN operating environment. Some of the major difficulties were:

- Formal training of application development in OS/2 was not available and there was no knowledgeable resource person to contact. The project team basically resolved most of the technical problems in-house through self-study and experimentation
- The software new release upgrades and fixes were very time consuming
- There were more system design changes than in traditional system development due to the newly discovered flexibility and capabilities of the data base engine, operating environment, and tools

- The procedures and standards had to be developed and modified along the way
- The development team was responsible for all hardware and software problems, such as hardware acquisition hold-up, the backup tape drive was not compatible with OS/2 2.0, etc. The exact cause of many problems was difficult to identify
- Network set up and administration took away valuable development time
- The distributed system required training and establishing easy to do steps in system back up, network administration, large volume printing, lengthy file transfer uploading and downloading procedures
- The data conversion process from IMS to the new data base structure was time consuming and difficult. The process was speeded up by changing from the utility load to inserting tables with a COBOL program
- Long running programs required many reviews and modifications to improve performance
- Interfacing data with other applications provided a few surprises, such as change in field format and length, and different coding structure

What We Have Learned From Our Experiences

In spite of the difficulties, this project was completed to the satisfaction of the users. From the technology development point of view, it was a big stepping stone to our next level of technology. Choosing Parking as our pilot distributed system was a good choice. It was an independent system yet there were many interfaces that we had to address. We have learned a great deal in relational data base technology, setting up the LAN, working with micro tools and the shift from mainframe program development to the GUI screen flexibility. The adventure of developing the distributed system with the user does fulfil a key strategic issue of CNS: "to provide a network infrastructure and the technical expertise and leadership to help users make effective use of network computing."[3] We were fortunate that we had a dedicated development team with some micro

[3] "Networking Computers and People on Campus and Beyond," Strategic Plan for Computing and Network Services, February 1992, p. 10

experience. "No one is perfect, but a team can," and indeed the entire team had to work very closely together. A lot of innovation and creative thought was needed in researching new ways to improve processes, as well as resolving problems.

The entire project team was able to stay focused on quality and system performance which were vital in developing a well structured system. Some of their knowledge of successful mainframe systems was transferred to micro development, such as parameter flexibility, table driven concept, and batch jobs test simulation, to provide a basis to maintain quality and standards.

Setting up standards early, such as the menu set up, the naming conventions, and program maintenance procedures, was very important. Many difficult decisions had to be made with insufficient knowledge. We were also prepared to modify and improve those procedures as our knowledge and expertise increased.

Parking and Physical Plant were committed to the project and they provided us with the utmost trust and cooperation. Parking Services had to adjust to extensive changes from a data entry batch system to a powerful on-line data management system. Their office was renovated to accommodate the new equipment. The staff had little system expertise and they had to rely on Physical Plant and CNS. Parking Services management decided to implement the Clancy hand-held units six months earlier than the system production date. That was one of the wisest decisions to reduce the stress of adjustments to two major changes at once.

The biggest lesson we have learned is that software development methodology is changing rapidly. The traditional structured approach is no longer effective for micro application development because of the tremendous flexibility available. It is important to solidly build the architecture and framework of the data base structure and the overall design. The final working screens and batch processing were constantly upgraded and changed for better performance. However, we did not compromise our primary objectives and requirements. Although we had to throw away some early stage unit design and code, we believe that in the end we gained productivity as well as performance, because of the persistence in improving each process.

Conclusion

We feel that we have successfully implemented our first distributed micro application and are proud of the final product. We have learned important lessons on the complete micro application development process including LAN set up, server and workstations management, file transfers, distributed program updates, data backup and job submission. The knowledge gained has been valuable for Physical Plant, Parking Services and CNS, from a department point of view, as well as from a University point of view.

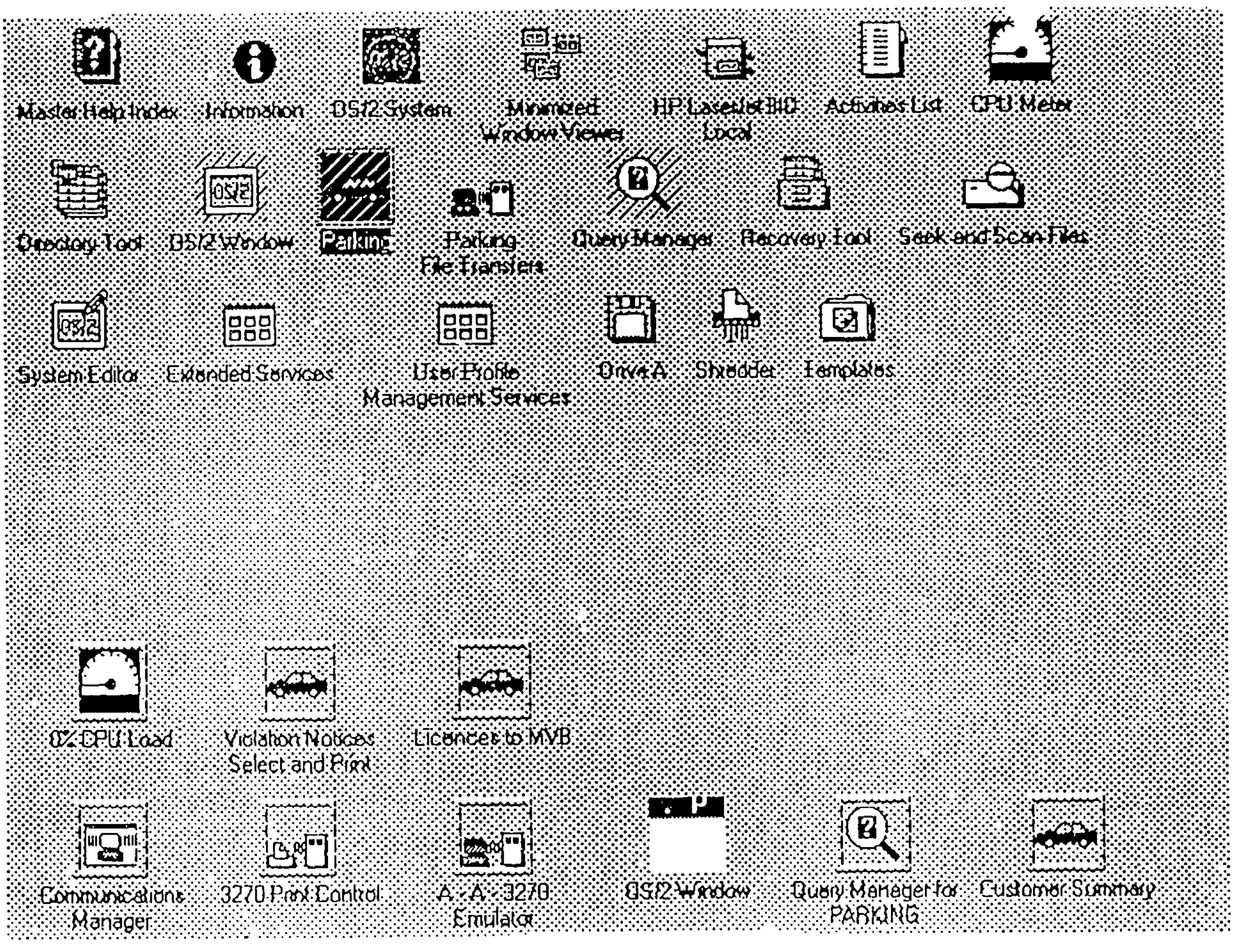
The users are pleased with the flexibility of maintaining their own system and generating their own reports easily. The parking staff now manage and maintain a Parking management system instead of being the data entry and verification clerks they were a few months ago. They still need to access the mainframe for file transfers, occasional encumbrances, and running a utility to create a licence file on cartridge. The dependence on the mainframe has reduced greatly and the system is cost effective for Parking Services.

We learned that migration to new technology is costly in time and resources but the experiences were invaluable. We did have fun along the road and hope that this experience will help us in our next technology upgrade to the University wide distributed environment.

On-line Demo

Now we would like to do a 15 minute demo of the parking system and show you some of the powerful screen presentation as well as the flexibility of the Query Manager for generating user reports.

Appendix A



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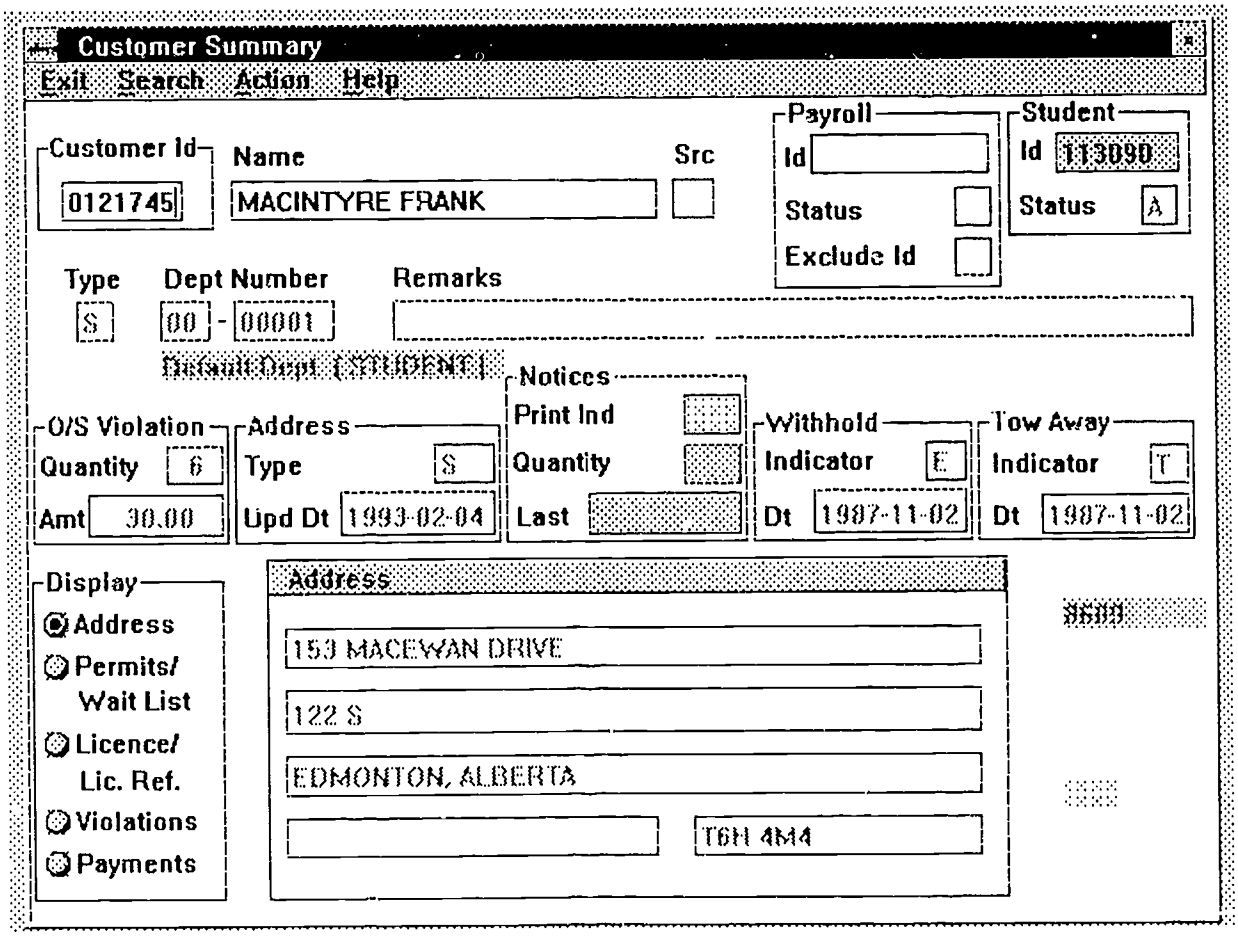
- Main On-Line Processes
  - Customer Summary
  - Licence Summary
  - Group Licence Query
  - Violation Payment
  - Violation Update
  - Violation Add
  - Permit / Wait List /Guest Park
  - Active Name Query
  - Name Match
  - Guest Booking Query

- Batch File Transfers
  - CARS Encumbrances
  - PLUS Payroll Deductions
  - JOBS Transactions
  - Licences to MVB

- Batch Updates
  - Permit Renewal Select & Print

Select | Exit | Help


Customer Summary
Exit Search Action Help
Customer Id
0121745
Name
MACINTYRE FRANK
Src
Payroll
Id
Status
Exclude Id
Student
Id 113090
Status A
Type
S
Dept Number
00 - 00001
Remarks
Default Dept [STUDENT]
Notices
Print Ind
Quantity
Last
O/S Violation
Quantity 6
Amt 30.00
Address
Type S
Upd Dt 1993-02-04
Withhold
Indicator E
Dt 1987-11-02
Tow Away
Indicator T
Dt 1987-11-02
Display
Address
Permits/ Wait List
Licence/ Lic. Ref.
Violations
Payments
Address
153 MACEWAN DRIVE
122 S
EDMONTON, ALBERTA
T6H 4M4

455

Licence Summary

Exit Search Actions Help

Province & Licence No.: AB ABUD4U

Source:

Customer: [illegible]

Fleet Ind.:

Vehicle Unit No.:

MVB Information

Name: Hum Baldwin

Birth Date: 1967-06-05

Vehicle Make: Toyota Corolla

Color: Red

Status: A

Last Update: 1993-02-01

O/S Violations

Quantity: 6

Amt.: 95.00

Tow-Away

Indicator: T

Date: [illegible]

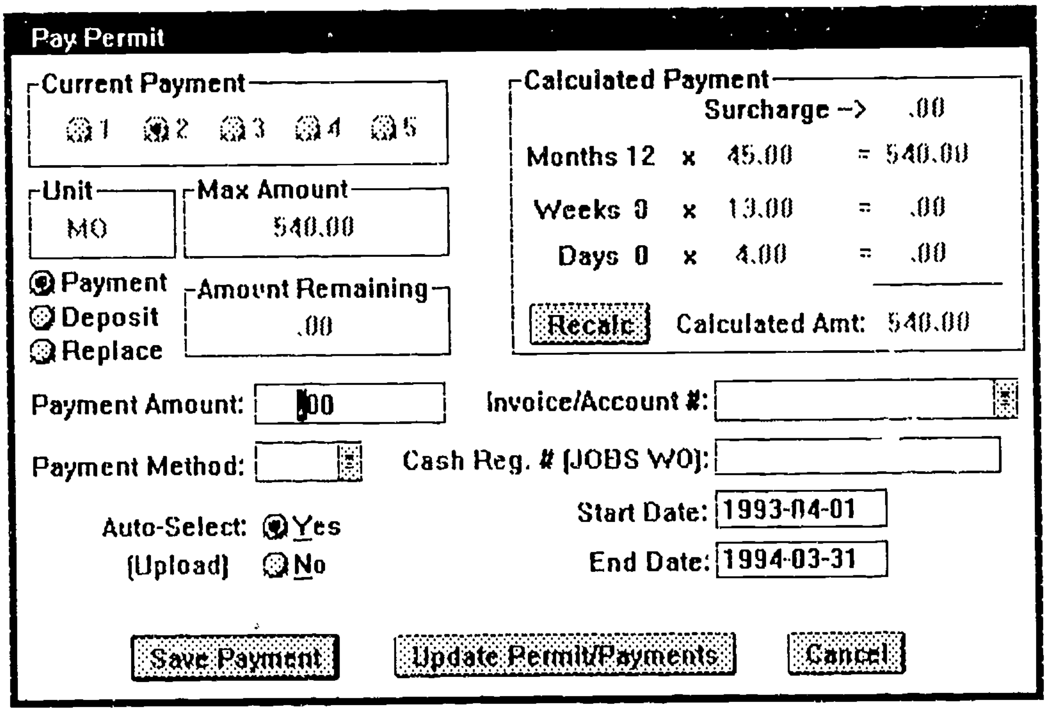
Violations

Ser	Number	Code	Date	IS.DS	Owed	App	Dec
04	450751	17	1991-05-14	. A	20.00		
04	455581	31	1991-05-23	. A	30.00	A1	D1
04	529663	04	1991-09-18	. A	5.00		
04	543711	04	1991-10-02	. A	5.00		
04	582491	31	1991-11-06	. A	30.00		

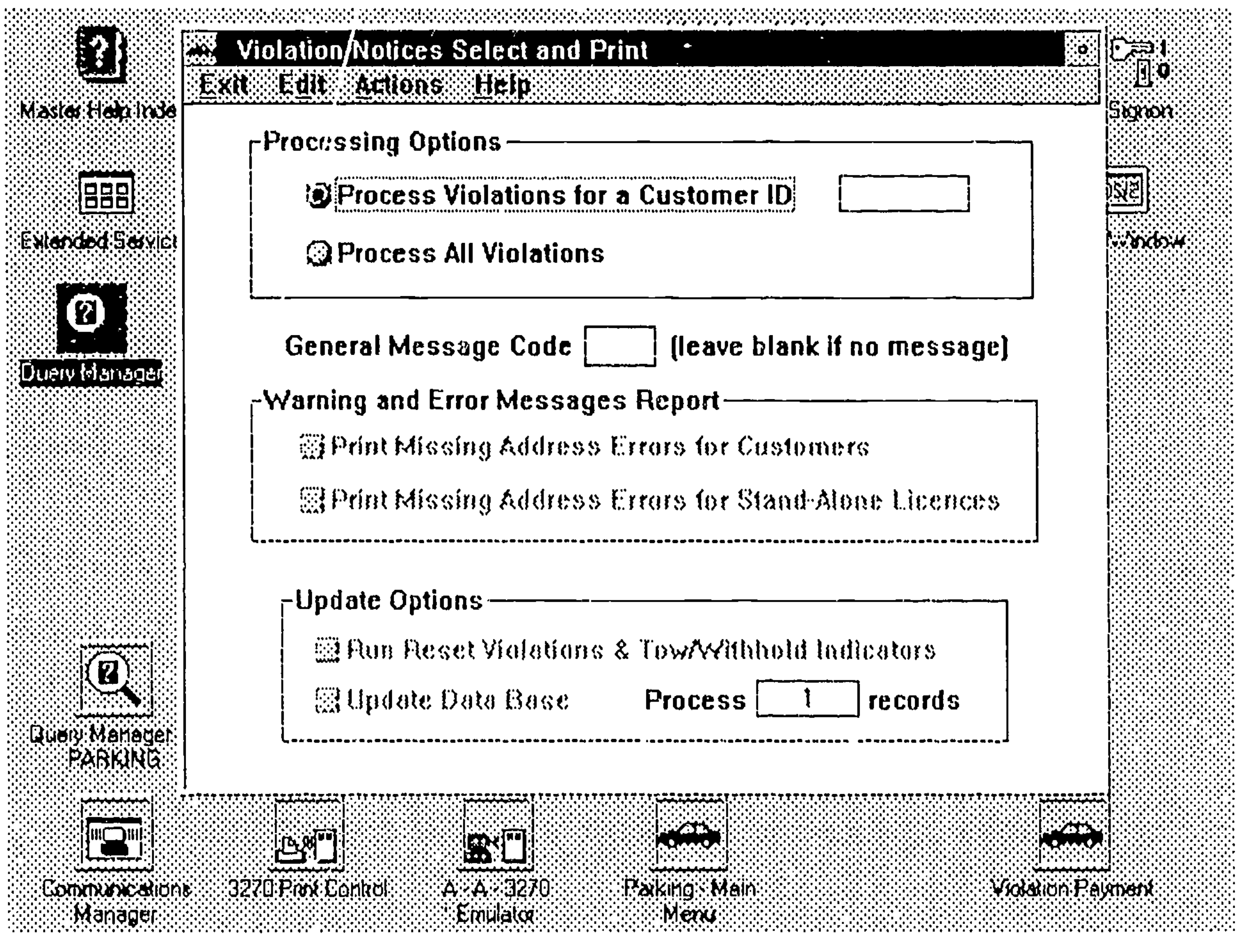
Display

- Address
- Customer
- Licence Ref
- Violations

436


Pay Permit
Current Payment
1 2 3 4 5
Unit
MO
Max Amount
540.00
Payment
Deposit
Replace
Amount Remaining
.00
Calculated Payment
Surcharge -> .00
Months 12 x 45.00 = 540.00
Weeks 0 x 13.00 = .00
Days 0 x 4.00 = .00
Recalc
Calculated Amt: 540.00
Payment Amount: .00
Invoice/Account #:
Payment Method:
Cash Reg. # (JOBS WO):
Auto-Select: Yes
(Upload) No
Start Date: 1993-04-01
End Date: 1994-03-31
Save Payment
Update Permit/Payments
Cancel

457



Violation/Notices Select and Print
Exit Edit Actions Help
Processing Options
Process Violations for a Customer ID
Process All Violations
General Message Code
(leave blank if no message)
Warning and Error Messages Report
Print Missing Address Errors for Customers
Print Missing Address Errors for Stand-Alone Licences
Update Options
Run Reset Violations & Tow/Withhold Indicators
Update Data Base
Process
1
records
Master Help Inde
Extended Servic
Query Manager
Query Manager PARKING
Signon
Communications Manager
3270 Print Control
A - A - 3270 Emulator
Parking - Main Menu
Violation Payment

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